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The Real Cost of WWII Wood Frame Buildings

US Army Corps
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Construction Engineering
Research Laboratory



# WWII Era Building Demolition and Renovation Cost Estimator (ESTER) 1.0 User's Manual

by
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Unit and system cost data associated with the renovation and repair of Army temporary wood frame buildings was incorporated into a user-friendly computer program, ESTER. By using ESTER, the estimation procedure is standardized at the installation level and calculation errors are minimized. This report details the installation and use of ESTER 1.0.

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Unit and system cost data associated with the renovation and repair of Army temporary wood frame buildings was incorporated into a user-friendly computer program, ESTER. By using ESTER, the estimation procedure is standardized at the Installation level and calculation errors are minimized. This report details the installation and use of ESTER 1.0.

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## FOREWORD

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The personnel from USA-CERL Environmental Division (EN) involved in the study were: John J. Fittipaldi, Principal Investigator, and Paul R. P. Skidmore, Research Assistant. Dr. R. K. Jain is the Chief of USA-CERL-EN. The Technical Editor was Gloria J. Wienke, Information Management Office.

COL Norman C. Hintz is Commander and Director of USA-CERL and Dr. L. R. Shaffer is the Technical Director.

## CONTENTS

# WWII ERA BUILDING DEMOLITION AND RENOVATION COST ESTIMATOR (ESTER) 1.0 USER'S MANUAL

## 1 INTRODUCTION

### Background

The onset of World War II (WWII) required the rapid construction of temporary wood buildings (TWBs) to satisfy the demand for barracks, administration buildings, maintenance buildings, and warehouses. Because they were considered temporary, many TWBs were excessed after the Korean War. However, thousands remain in use, and are needed to satisfy installation mission objectives.

Many of these buildings are in various states of disrepair, generally due to use, age, and neglect. However, there may be economic justification to upgrade and repair TWBs to minimal habitability standards or higher, for mobilization (MOB) or peacetime purposes.[1] A closer examination of the cost of repairing and remodeling these buildings is indicated.[2] Various cost estimation techniques are currently used to determine TWB renovation costs, but few are accurate enough to give significant estimates.

### Objective

The objective of this study was to create an easy-to-use, accurate method of estimating repair and remodeling costs of WWII era TWBs.

### Approach

Because many commercial contractors use an individually modified version of Means unit cost data[3] for cost estimation, the 1987 Means repair and remodeling cost data was transferred into an interactive, user-friendly computer program called ESTER.

The need to include regional cost adjustment factors (CAF) was recognized, and ESTER contains an option for the user to input CAF based on information included in Means, Army Regulation (AR) 415-17,[4] or other appropriate sources. Means and AR 415-17 cost adjustment factors are included in Appendix A.

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[1] David Reed et al., *Evaluation and Guidelines for the Use of Temporary Wood Buildings at U.S. Army Installations*, TR N-88/06 (U.S. Army Construction Engineering Research Laboratory [USA-CERL], April 1988).

[2] Peter Schaeffer, John J. Fittipaldi, and Paul Armstrong, *An Economic Assessment of Renovating Temporary Wood Frame Buildings*, Draft Technical Report (USA-CERL, November 1987).

[3] *Repair and Remodeling Cost Data Commercial/Residential* (R. S. Means Company, Inc., 1987).

[4] Army Regulation (AR) 415-17, *Cost Estimating for Military Programming* (U.S. Army Corps of Engineers, 15 February 1980).

## Mode of Technology Transfer

The program disks for the WWII Era Building Demolition and Renovation Cost Estimator (ESTER) are available from the Environmental (EN) Division of the U.S. Army Construction Engineering Research Laboratory (USA-CERL). The commented 'C' source code is also available upon request. Scheduling of updates to ESTER will be determined based on the use level of this program.

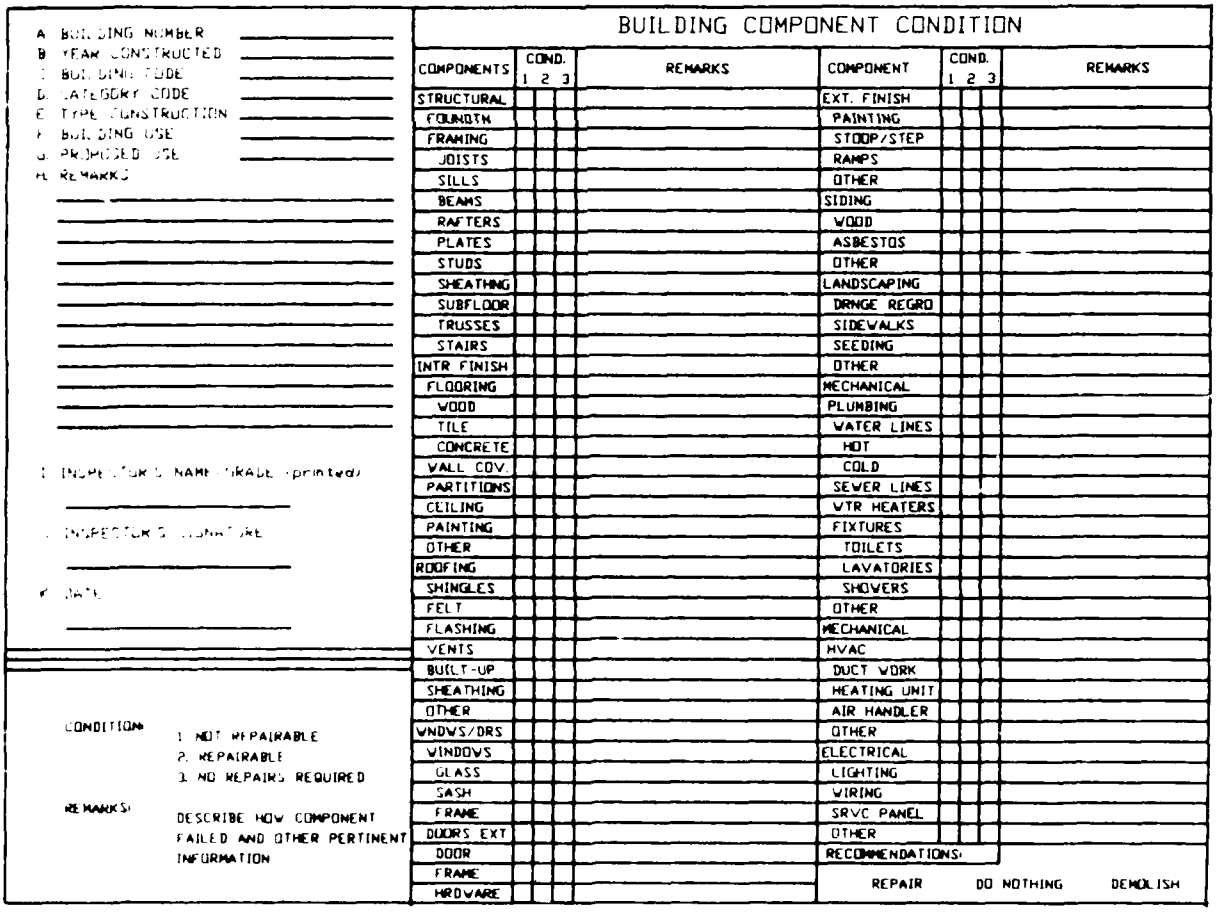
## 2 PROGRAM DESCRIPTION

ESTER accepts numerical and single keypress input, computes costs based on Means cost data, and adjusts the major building components' costs with the appropriate regional cost factor index. You must enter complete and accurate input for ESTER to calculate complete and accurate output. An input template (Figure 1) lists each major section in the program, and the required input units. This template can be used in the field, and the data from the template can then be easily transferred to ESTER. The data thus generated can then, at your option, be saved as an American Standard for Coded Information Interchange (ASCII) file, suitable for printout.

### System Overview

ESTER runs on any IBM-PC compatible microcomputer with a minimum of 256K RAM and one 360K disk drive. A hard disk drive is recommended, but not required.

The program is written in the 'C' programming language, and is therefore highly portable between different computer systems (Appendixes B and C). ESTER 1.0 consists of three separate program units. The first, ESTER.EXE, is the driver program that



A. BUILDING NUMBER _____
B. YEAR CONSTRUCTED _____
C. BUILDING CODE _____
D. CATEGORY CODE _____
E. TYPE CONSTRUCTION _____
F. BUILDING USE _____
G. PROPOSED USE _____
H. REMARKS

I. INSPECTOR'S NAME/GRADE (printed)

J. INSPECTOR'S SIGNATURE

K. DATE

CONDITION: 1. NOT REPAIRABLE
2. REPAIRABLE
3. NO REPAIRS REQUIRED

REMARKS: DESCRIBE HOW COMPONENT FAILED AND OTHER PERTINENT INFORMATION

BUILDING COMPONENT CONDITION

| COMPONENTS | COND. 1 2 3 | REMARKS | COMPONENT | COND. 1 2 3 | REMARKS |
|---|---|---|---|---|---|
| STRUCTURAL | | | EXT. FINISH | | |
| FOUNDTN | | | PAINTING | | |
| FRAMING | | | STOOP/STEP | | |
| JOISTS | | | RAMPS | | |
| SILLS | | | OTHER | | |
| BEAMS | | | SIDING | | |
| RAFTERS | | | WOOD | | |
| PLATES | | | ASBESTOS | | |
| STUDS | | | OTHER | | |
| SHEATHNG | | | LANDSCAPING | | |
| SUBFLOOR | | | DRNGE REGRD | | |
| TRUSSES | | | SIDEWALKS | | |
| STAIRS | | | SEEDING | | |
| INTR FINISH | | | OTHER | | |
| FLOORING | | | MECHANICAL | | |
| WOOD | | | PLUMBING | | |
| TILE | | | WATER LINES | | |
| CONCRETE | | | HOT | | |
| WALL COV. | | | COLD | | |
| PARTITIONS | | | SEWER LINES | | |
| CEILING | | | WTR HEATERS | | |
| PAINTING | | | FIXTURES | | |
| OTHER | | | TOILETS | | |
| ROOFING | | | LAVATORIES | | |
| SHINGLES | | | SHOWERS | | |
| FELT | | | OTHER | | |
| FLASHING | | | MECHANICAL | | |
| VENTS | | | HVAC | | |
| BUILT-UP | | | DUCT WORK | | |
| SHEATHNG | | | HEATING UNIT | | |
| OTHER | | | AIR HANDLER | | |
| WNDWS/DRS | | | OTHER | | |
| WINDOWS | | | ELECTRICAL | | |
| GLASS | | | LIGHTING | | |
| SASH | | | WIRING | | |
| FRAME | | | SRVC PANEL | | |
| DOORS EXT | | | OTHER | | |
| DOOR | | | RECOMMENDATIONS: | | |
| FRAME | | | REPAIR | DO NOTHING | DEMOLISH |
| HRDWARE | | | | | |

**Figure 1. Entry template.**

invokes the two child processes, demolition (DEMO.EXE) and rehabilitation (REHAB.EXE). Depending on your input, subroutines within each of these major program units are called to determine each unit cost (Appendix C). The program is menu driven. All of the options available at any one time are displayed onscreen, with the corresponding prompts waiting for your input.

After completing data entry, you can elect to save the tabulated results in a formatted ASCII file, using a filename you have chosen. A '.DEM' or '.RHB' extender will be automatically added, dependent upon the child process. You may, if not interested in a permanent record, view any portion of the input values and intermediate results by entering the appropriate review menu any time the program is running.

The results generated by ESTER can then be used as a foundation of intelligent data to more accurately view the building repair and renovation options available to you.

## Program Setup

Because ESTER uses ANSI (American National Standards Institute) extended screen and keyboard control escape sequences for efficient screen control, you may have to install the ANSI.SYS device driver within the CONFIG.SYS file on the root directory, and then reboot the computer. Sample copies of the required CONFIG.SYS and ANSI.SYS are included on the program disk, and if both are installed on the root directory of the boot-up disk (either on a hard disk or drive A), correct screen control within the program is assured. Within the CONFIG.SYS, the following statement must be included:*

**DEVICE=[d:][path]ANSI.SYS**

This command causes DOS to replace the standard input and standard output support with the extended functions.

The following steps are suggested for organized operation of ESTER:

*Hard Disk Users*

1. MAKE A BACKUP DISK! For information on creating a backup disk, see the disk operating manual that came with the computer.

   **COPY *.* C:**
   [copies all files in drive a to drive c]

2. A suggested hard disk management system would be to make an ESTER directory and transfer the entire contents of the program disk into the new directory.

   **C> MKDIR ESTER**
   [Makes an ESTER directory in drive c]

   **C> COPY A:*.* C:\ESTER**
   [Copies all files in drive a to the ESTER directory in drive c]

*User input is shown in bold face throughout this report.

3. Enter the ESTER directory and run program.

   **C> CD ESTER**
   [Change current working directory to ESTER]

   **C> ESTER**
   [Run ESTER 1.0 program]

4. Check that the program operates correctly.

*Floppy Disk Users*

1. MAKE A BACKUP DISK! For information on creating a backup disk, see the disk operating manual that came with the computer.

   **A> COPY *.* B:**
   [copies all files in drive a to drive b]

2. Ensure that computer was booted-up with new CONFIG.SYS file as provided on the program disk and explained in the Program Setup section.

3. Run program from floppy drive.

   **A> ESTER**
   [Run ESTER 1.0 program]

4. Check that the program operates correctly.

After you follow the above instructions corresponding to your system, the program drive will spin, the screen will clear, and the ESTER 1.0 title screen should appear. If it doesn't appear, make sure that the CONFIG.SYS is on the root directory, and that the path name to the ANSI.SYS driver is correct. From this point on, the program is menu driven and relatively self-explanatory.

**Program Run**

The introductory screen looks like Figure 2. Press [Return] to continue. The program will prompt for a building identification name. Enter a name less than 25 characters, and press [Return]. The program then prompts for a building length. Enter the length in feet, and press [Return]. (The program will only accept integer values. Round off fractional measurements.) This system of data entry continues with building width, number of stories, and floor-to-floor height. The final prompt asks for a CAF percentage value. Input an appropriate three digit number. The program will then ask you to verify the CAF value. A [Y] keypress will clear the screen and display the entered values that will be used throughout the program's run. These values will remain constant until you reinitialize the constants (further explained in the following section).

To move to the main menu, press [Return] once more, and a new screen display will appear similar to that shown in Figure 3. This is the main driver menu for the program, and is used to initiate the demolition and renovation child processes, and to reinitialize the program constants. An [R] keypress allows you to reenter the program constants by going back to the introductory screen. Note that a [Return] keypress is not necessary.

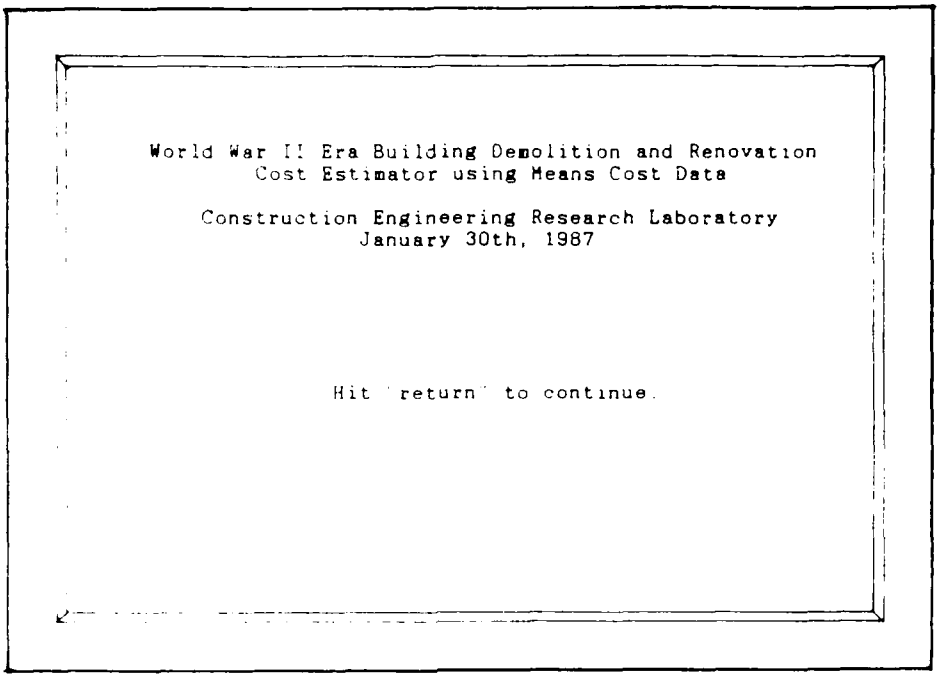



**Figure 2. Introductory screen.**

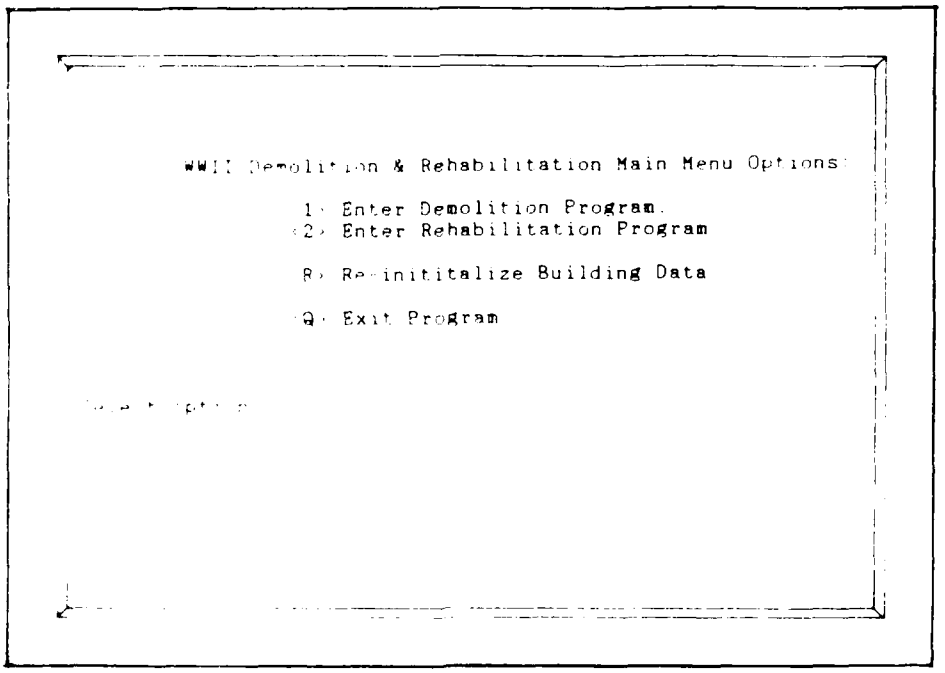



**Figure 3. Main driver menu.**

The data reinitialization follows the same format as previously explained. Entering a [1] or [2] at the prompt will initiate the chosen child process. A status screen indicating that the selected child process is loading will appear. If the load is successful, a new main menu screen is displayed (see Figures 4 and 5) with the options of entering the data, reviewing the data, saving the data as an ASCII file, and exiting the process.

*Option 1—Enter Data*

Pressing [1] clears the screen to display the main data menu. The main headings direct you down through the option tree, from general to specific, until you have entered the specific item cost. The program will prompt for the correct input (linear feet, square feet, or number of units). In many instances, after the data has been entered, the program returns to the specific item menu. This gives you the option of entering new unit cost data for a different item in the same unit category. The result returned will automatically be added to any previous total for the unit category to give a cumulative result. Exceptions to the cumulative result method are for units that are customarily entered only once. To differentiate between the two, the costs for once only categories are designated as 'Total' costs and additive cost groups are designated as 'Cumulative.' An example would be the roofing category. One shingle type, felt type, and sheathing type, would commonly be used, not a combination of many systems.

The roofing category also differs in that each item that customarily comprises a roofing system is automatically displayed, awaiting your input.

Note that the program accepts negative as well as positive values for input. This feature can be used for immediate correction or manipulation of entered data.

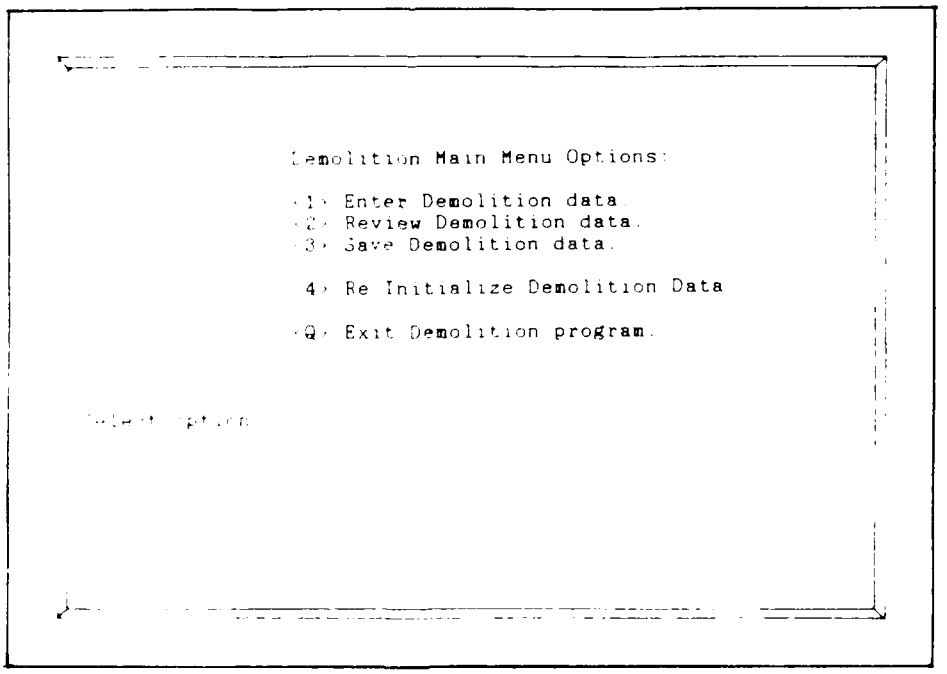



**Figure 4. Demolition main menu.**

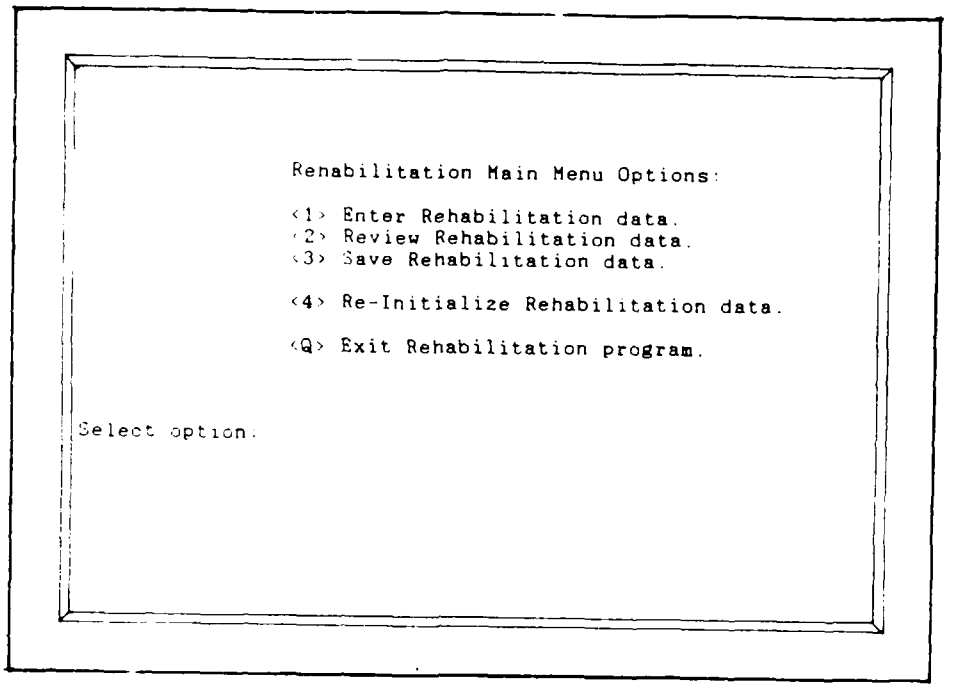



**Figure 5. Rehabilitation main menu.**

From anywhere within the child process program, a series of [E] keystrokes is all that is required to return to the main menu. The exact number of [E] keystrokes depends on how far down the option tree you are entering data.

*Option 2—Review Data*

Pressing [2] will clear the screen and bring up a new menu. This menu gives you the opportunity to display intermediate results on the screen anytime during the program run. This feature can be used to determine if the required data has been entered for each unit category, or for intermediate results for comparative purposes. To review entered and tabulated data for a specific building system category, enter the appropriate number at the review menu prompt. The screen will clear and the formatted results will be displayed, listing each major component in the building category, the number of total units entered, the individual component cost, the overall building system category cost, and the overall CAF cost. The overall review category (option [9] from the review menu) lists the costs for each building system category, the CAF cost for each category, the totals of each, and the cost per square foot, both adjusted and unadjusted. To return to the main menu, press [E].

*Option 3—Save Data*

Pressing [3] clears the screen and displays the 'save' subroutine. At the prompt, enter a file name less than nine characters long. Either an '.RHB' or '.DEM' extender will automatically be added to the end of the chosen file name. If you input a name with more than eight characters, the data will still be saved, but the file name will be truncated to only the first eight characters. The respective extender will not be added in this situation. For example, while in the rehabilitation process, entering 'BUILDING_

ONE' at the filename prompt will save the data as 'BUILDING'. If, however you enter 'BLDG_ONE' at the prompt, the data will be saved in a file titled 'BLDG_ONE.RHB'.

In some instances, you may enter an invalid file name. The program automatically checks for file name validity and will return an error message if the file name is invalid. The screen will then return to the main menu to allow you to try again.

It is important to note that the file will be saved to the active disk drive. This means that the data will be saved to the program disk for floppy drives. There is enough room on the program disk for many saves, but it is advisable to format a floppy disk for the express purpose of storing ESTER data saves. Insert the data disk in the active drive before the save, remove the disk after the save is complete, and replace the program disk before continuing.

*Option 4—Reinitialize Data*

Pressing [4] clears the screen and requests verification, for data deletion. A [Y] keypress will clear any data that has been entered during the session. This can be used to effectively compare the costs associated with different construction techniques. One method can be entered, the total cost noted, and then cleared from memory. Various other methods of building construction can then be entered, and the associated costs can then be totaled and compared. If a key other than a [Y] is pressed at the verification screen, the main menu within the child process will appear, and the data will remain untouched, ready for saving or further manipulation.

*Option Q—Exit Child Process*

Pressing [Q] will exit the child process and return control to the parent or driver program. Before this process is completed, a warning screen will appear advising you that all data entered during the child process will be deleted from memory. If this is acceptable, a [Y] keypress will clear the screen and the main driver menu will be displayed. If you do not wish to delete the data, any other keypress will return to the main menu in the child process where you have the option to save the data before exiting.

## 3 SUMMARY

The usefulness of any cost estimation program depends on the detail with which the overall building is defined, the applicability and accuracy of the unit cost variables used, and the precision of the unit data entry. The last factor is the user's responsibility; the other two fall under program jurisdiction. The building breakdown used in ESTER is not comprehensive for all building types, but is a manageable mix of system and unit cost breakdowns for wood frame buildings in general, and specifically WWII temporary buildings. There will undoubtedly be some omissions in building unit choice, but comparable items can generally be substituted for the actual item. Any omissions identified by user response to the program will be included in future updates.

The unit cost variables used in ESTER 1.0 are from Means cost data and are based on national averages, including material, labor, equipment, overhead, and profit. The 1987 data should give reasonable results for 2 or 3 years. Updates should therefore be furnished on a biennial basis.

ESTER now stores all the values in a header file that is loaded directly into the computer's memory. Any subsequent version of ESTER will have a program to allow the user to change and refine any of the unit cost values used by the program to reflect local averages.

## APPENDIX A:

## REGIONAL COST ADJUSTMENT FACTORS

The data values used throughout ESTER are derived from Means Repair and Remodeling Cost Data, 1987. To get the national average, the CAF should be set at 100.00 (corresponding to 100 percent). Means uses a method called a City Cost Index which includes weighted averages, as well as the major division indexes for each major U.S. city. Use of the appropriate CAF can greatly influence the total cost of a project. It is recommended that every installation have a copy of the current Means guide, or similar documentation. The City Cost Index used by Means corresponds to the Area Cost Factor Indexes used by the Corps. This correspondence does not extend to the actual values, however. It is up to the user to choose the more applicable CAF, or choose another factor. A listing of Continental United States (CONUS) Installations Area Cost Factor Indexes, FY 88 from Engineering Improvement Recommendation System (EIRS) Bulletin 86-03 (U.S. Army Corps of Engineers) follows.

CONUS INSTALLATIONS
AREA COST FACTOR INDEXES

| STATE | LOCATION | ACF INDEX |
|---|---|---|
| Alabama | STATE AVERAGE | .86 |
| | BIRMINGHAM | .96 |
| | MOBILE | .86 |
| | MONTGOMERY | .76 |
| | ANNISTON ARMY DEPOT | .81 |
| | HUNTSVILLE | .88 |
| | FORT MCCLELLAN | .80 |
| | REDSTONE ARSENAL | .88 |
| | FORT RUCKER | .80 |
| Alaska | STATE AVERAGE | 2.25 |
| | ANCHORAGE | 1.92 |
| | DELTA JUNCTION | 2.70 |
| | FAIRBANKS | 2.13 |
| | ADAK | 3.88 |
| | ALEUTIAN ISLANDS | 3.86 |
| | ANCHORAGE NSGA | 1.92 |
| | BARROW | 4.18 |
| | BURNT MTN. | 6.86 |
| | CLEAR | 3.10 |
| | EIELSON AFB | 2.13 |
| | ELMENDORF AFB | 1.92 |
| | GALENA | 3.73 |
| | FORT GREELY | 2.70 |
| | FORT RICHARDSON | 1.92 |
| | FORT WAINWRIGHT | 2.13 |
| Arizona | STATE AVERAGE | 1.02 |
| | FLAGSTAFF | 1.02 |
| | PHOENIX | .99 |
| | TUCSON ARIZONA | 1.05 |
| | FORT HUACHUCA | 1.22 |
| | YUMA PROVING GROUND | 1.31 |
| | YUMA | 1.31 |
| Arkansas | STATE AVERAGE | .89 |
| | PINEBLUFF | .93 |
| | LITTLE ROCK | .83 |
| | FORT SMITH | .92 |
| | FORT CHAFFEE | .92 |
| | PINE BLUFF ARSENAL | .93 |
| California | STATE AVERAGE | 1.21 |
| | LOS ANGELES | 1.20 |
| | SAN DIEGO | 1.18 |
| | SAN FRANCISCO | 1.25 |
| | BEALE | 1.28 |
| | BRIDGEPORT NWTC | 1.27 |
| | CASTLE | 1.13 |
| | CENTERVILLE BEACH | 1.32 |
| | DESERT AREA | 1.18 |
| | EDWARDS AFB | 1.30 |

CONUS INSTALLATIONS
AREA COST FACTOR INDEXES

| STATE | LOCATION | ACF INDEX |
|---|---|---|
| California | EL CENTRO | 1.27 |
| | GEORGE AFB | 1.31 |
| | FORT HUNTER LIGGETT | 1.29 |
| | FORT IRWIN | 1.20 |
| | LE MOORE NAS | 1.20 |
| | MARCH AFB | 1.18 |
| | MATHER AFB | 1.17 |
| | MCCLELLAN AFB | 1.17 |
| | MONTEREY AREA | 1.23 |
| | PRESIDIO OF MONTEREY | 1.23 |
| | NORTON AFB | 1.16 |
| | OAKLAND ARMY BASE | 1.33 |
| | FORT ORD | 1.24 |
| | PORT HUENEMA AREA | 1.20 |
| | RIVERSIDE | 1.18 |
| | SACRAMENTO | 1.15 |
| | SACRAMENTO ARMY DEPOT | 1.15 |
| | PRESIDIO OF SAN FRANCISCO | 1.25 |
| | SAN NICHOLAS ISLAND | 2.59 |
| | SHARPE ARMY DEPOT | 1.13 |
| | SIERRA ARMY DEPOT | 1.33 |
| | STOCKTON | 1.15 |
| | TRAVIS AFB | 1.27 |
| | VANDENBURG AFB | 1.38 |
| Colorado | STATE AVERAGE | .98 |
| | COLORADO SPRINGS | .94 |
| | DENVER | 1.04 |
| | PUEBLO | .96 |
| | FORT CARSON | 1.01 |
| | FITZSIMONS AMC | 1.06 |
| | PUEBLO ARMY DEPOT | .96 |
| | PETERSON AFB | .94 |
| | ROCKY MOUNTAIN ARSENAL | 1.06 |
| Connecticut | STATE AVERAGE | 1.13 |
| | BRIDGEPORT | 1.16 |
| | HARTFORD | 1.10 |
| | NEW LONDON | 1.14 |
| Delaware | STATE AVERAGE | .99 |
| | DOVER | 1.04 |
| | LEWES | .98 |
| | MILFORD | .96 |
| | LEWES NF | 1.04 |
| | DOVER AFB | 1.04 |
| District of Columbia | WASHINGTON D C | 1.03 |
| | FORT MCNAIR | 1.03 |
| | WALTER REED AMC | 1.03 |
| Florida | STATE AVERAGE | .89 |
| | MIAMI | .95 |

CONUS INSTALLATIONS
AREA COST FACTOR INDEXES

| STATE | LOCATION | ACF INDEX |
|---|---|---|
| Florida | PANAMA CITY | .92 |
| | TAMPA | .79 |
| | CAPE CANAVERAL | .96 |
| | CAPE KENNEDY | .96 |
| | GULF COAST | .85 |
| | HOMESTEAD AFB | .88 |
| | HOMESTEAD | .88 |
| | JACKSONVILLE AREA | .85 |
| | KEY WEST NAS | 1.08 |
| | ORLANDO | .80 |
| | PENSACOLA AREA | .85 |
| | MCDILL AFB | .77 |
| | EGLIN AFB | .85 |
| | TYNDELL AFB | .92 |
| Georgia | STATE AVERAGE | .80 |
| | ALBANY | .82 |
| | ATLANTA | .87 |
| | MACON | .70 |
| | ATHENS | .90 |
| | ATLANTA-MARIETTA | .93 |
| | FORT BENNING | .71 |
| | COLUMBUS | .71 |
| | FORT GILLEM | .87 |
| | FORT GORDON | .94 |
| | KINGS BAY | .93 |
| | FORT MCPHERSON | .87 |
| | FORT STEWART | .84 |
| Hawaii | STATE AVERAGE | 1.28 |
| | HAWAII | 1.29 |
| | HONOLULU | 1.27 |
| | MAUI | 1.29 |
| | ALIMANU | 1.27 |
| | BARBERS POINT NAS | 1.34 |
| | FORT DERUSSY | 1.27 |
| | EWA BEACH AREA | 1.34 |
| | HELEMANO | 1.34 |
| | HICKAM ARMY AIR FIELD | 1.27 |
| | KANEOHE MCAS | 1.34 |
| | MOANALUA | 1.27 |
| | PEARL CITY | 1.27 |
| | PEARL HARBOR | 1.27 |
| | POHAKULOA | 1.32 |
| | SCHOFILED BARRACKS | 1.27 |
| | FORT SHAFTER | 1.27 |
| | TRIPLER AMC | 1.27 |
| | WHEELER ARMY AIR FIELD | 1.34 |
| Idaho | STATE AVERAGE | 1.11 |
| | BOISE | 1.05 |

CONUS INSTALLATIONS
AREA COST FACTOR INDEXES

| STATE | LOCATION | ACF INDEX |
|---|---|---|
| Idaho | IDAHO FALLS | 1.08 |
| | MOUNTAIN HOME | 1.19 |
| | MOUNTAIN HOME AFB | 1.20 |
| Illinois | STATE AVERAGE | 1.03 |
| | BELLEVILLE | .96 |
| | CHICAGO | 1.09 |
| | ROCK ISLAND | 1.03 |
| | ROCK ISLAND ARSENAL | 1.06 |
| | SAINT LOUIS SUPPORT CTR | .96 |
| | SAVANNAH ARMY DEPOT | 1.05 |
| | SCOTT AFB | 1.03 |
| | FORT SHERIDAN | 1.10 |
| Indiana | STATE AVERAGE | .99 |
| | INDIANAPOLIS | 1.03 |
| | LOGANSPORT | .99 |
| | MADISON | .94 |
| | FORT BENJAMIN HARRISON | 1.07 |
| | CRANE | 1.10 |
| | CRANE AAP | 1.10 |
| | GRISSOM AFB | 1.06 |
| | INDIANA AAP | 1.02 |
| | JEFFERSON PROVING GROUND | .94 |
| Iowa | STATE AVERAGE | 1.02 |
| | BURLINGTON | 1.04 |
| | CEDAR RAPIDS | .98 |
| | DES MOINES | 1.05 |
| | IOWA AAP | 1.06 |
| Kansas | STATE AVERAGE | .94 |
| | MANHATTAN | .97 |
| | TOPEKA | .96 |
| | WICHITA | .88 |
| | KANSAS AAP | .94 |
| | FORT LEAVENWORTH | .94 |
| | FORT RILEY | .97 |
| | SUNFLOWER AAP | .97 |
| Kentucky | STATE AVERAGE | .96 |
| | BOWLING GREEN | .99 |
| | LEXINGTON | .96 |
| | LOUISVILLE | .93 |
| | FORT CAMPBELL | .93 |
| | FORT KNOX | .99 |
| | LEXINGTON/BLUEGRASS ARMY DEP | 1.06 |
| | LOUISVILLE NAS | .93 |
| Louisiana | STATE AVERGE | .92 |
| | ALEXANDRIA | .87 |
| | NEW ORLEANS | .94 |
| | SHREVEPORT | .94 |
| | BARKSDALE AFB | .94 |

CONUS INSTALLATIONS
AREA COST FACTOR INDEXES

| STATE | LOCATION | ACF INDEX |
|---|---|---|
| Louisiana | ENGLAND AFB | .87 |
| | GULF OUTPORT NEW ORLEANS | .94 |
| | LOUISIANA AAP | .94 |
| | FORT POLK | .94 |
| Maine | STATE AVERAGE | .93 |
| | BANGOR | .85 |
| | CARIBOU | .99 |
| | PORTLAND | .94 |
| | BRUNSWICK | .93 |
| | CUTLER | .98 |
| | NORTHERN AREA | 1.17 |
| | WINTER HARBOR | .98 |
| Maryland | STATE AVERAGE | .97 |
| | BALTIMORE | .95 |
| | FREDRICK | .94 |
| | LEXINGTON PARK | 1.01 |
| | ABERDEEN PROVING GROUND | .94 |
| | ANNAPOLIS | 1.03 |
| | FORT DETRICK | .94 |
| | HARRY DIAMOND LAB | 1.00 |
| | FORT MEADE | .95 |
| | PATUXENT RIVER AREA | 1.08 |
| | FORT RITCHIE | .90 |
| Massachusetts | STATE AVERAGE | 1.10 |
| | BOSTON | 1.13 |
| | FITCHBURG | 1.08 |
| | SPRINGFIELD | 1.08 |
| | ARMY MTLS & MECH RSCH CTR | 1.13 |
| | FORT DEVENS | 1.15 |
| | NATICK RSCH & DEVELMNT CTR | 1.13 |
| | SOUTH WEYMOUTH | 1.13 |
| Michigan | STATE AVERAGE | 1.06 |
| | BAY CITY | 1.02 |
| | DETROIT | 1.14 |
| | MARQUETTE | 1.03 |
| | DETROIT ARSENAL | 1.14 |
| | NORTHERN AREA | 1.25 |
| | REPUBLIC (ELFCOM) | 1.10 |
| | SELFRIDGE AFB | 1.14 |
| Minnesota | STATE AVERAGE | 1.08 |
| | DULUTH | 1.05 |
| | MINNEAPOLIS | 1.09 |
| | ST. CLOUD | 1.10 |
| | TWIN CITIES AAP | 1.09 |
| Mississippi | STATE AVERAGE | .84 |
| | BILOXI | .87 |
| | COLUMBUS | .81 |
| | JACKSON | .84 |

CONUS INSTALLATIONS
AREA COST FACTOR INDEXES

| STATE | LOCATION | ACF INDEX |
|---|---|---|
| Mississippi | COLUMBUS AFB | .81 |
| | GULF PORT AREA | .87 |
| | MERIDIAN | .92 |
| Missouri | STATE AVERAGE | .92 |
| | KANSAS CITY | .92 |
| | ST. LOUIS | .99 |
| | ROLLA | .85 |
| | LAKE CITY AAP | .93 |
| | FORT LEONARD WOOD | .91 |
| Montana | STATE AVERAGE | 1.15 |
| | BILLINGS | 1.15 |
| | BUTTE | 1.18 |
| | GREAT FALLS | 1.12 |
| | MALMSTROM AFB | 1.12 |
| Nebraska | STATE AVERAGE | 1.03 |
| | GRAND ISLAND | 1.00 |
| | LINCOLN | 1.05 |
| | OMAHA | 1.05 |
| | OFFUTT AFB | 1.05 |
| Nevada | STATE AVERAGE | 1.18 |
| | HAWTHORNE | 1.26 |
| | LAS VEGA | 1.13 |
| | RENO | 1.15 |
| | FALLON | 1.28 |
| | HAWTHORNE AAP | 1.26 |
| | NELLIS AFB | 1.13 |
| New Hampshire | STATE AVERAGE | 1.09 |
| | CONCORD | 1.06 |
| | NASHUA | 1.06 |
| | PORTSMOUTH | 1.14 |
| | COLD REGIONS LAB | 1.17 |
| New Jersey | STATE AVERAGE | 1.08 |
| | NEWARK | 1.11 |
| | RED BANK | 1.08 |
| | TRENTON | 1.06 |
| | BAYONNE | 1.10 |
| | BAYONNE MIL OCEAN TERM | 1.09 |
| | FORT DIX | 1.03 |
| | EARLE | 1.10 |
| | LAKEHURST | 1.05 |
| | FORT MONMOUTH | 1.09 |
| | PICATINNY ARSENAL | 1.20 |
| New Mexico | STATE AVERAGE | 1.03 |
| | ALAMOGORDO | .99 |
| | ALBUQUERQUE | 1.03 |
| | GALLUP | 1.06 |
| | HOLLOMAN AFB | 1.05 |
| | KIRTLAND AFB | 1.03 |

CONUS INSTALLATIONS
AREA COST FACTOR INDEXES

| STATE | LOCATION | ACF INDEX |
|---|---|---|
| New Mexico | WHITE SANDS MISSILE RANGE | 1.09 |
| | FORT WINGATE | 1.06 |
| New York | STATE AVERAGE | 1.12 |
| | ALBANY | 1.07 |
| | NEW YORK CITY | 1.24 |
| | SYRACUSE | 1.05 |
| | BROOKLYN | 1.24 |
| | FORT DRUM | 1.18 |
| | FORT HAMILTON | 1.24 |
| | SENECA ARMY DEPOT | 1.15 |
| | U S MILITARY ACADEMY | 1.17 |
| | WATERVLIET ARSENAL | 1.07 |
| North Carolina | STATE AVERAGE | .76 |
| | FAYETTEVILLE | .76 |
| | GREENSBORO | .75 |
| | WILMINGTON | .78 |
| | FORT BRAGG | .76 |
| | CAMP LEJEUNE AREA | .86 |
| | CHERRY POINT | .86 |
| | GOLDSBORO | .77 |
| | POPE AFB | .82 |
| | SEYMOUR AFB | .77 |
| | SUNNY POINT MIL OCEAN TERM | .78 |
| North Dakota | STATE AVERAGE | 1.03 |
| | BISMARCK | 1.02 |
| | GRAND FORKS | .98 |
| | MINOT | 1.10 |
| | GRAND FORKS AFB | .98 |
| | STANLEY R. MICKLESEN CPX | 1.03 |
| | MINOT AFB | 1.12 |
| Ohio | STATE AVERAGE | 1.00 |
| | COLUMBUS | 1.03 |
| | DAYTON | .98 |
| | YOUNGSTOWN | .99 |
| | CLEVELAND | 1.14 |
| | WRIGHT-PATTERSON AFB | .98 |
| Oklahoma | STATE AVERAGE | .93 |
| | LAWTON | .90 |
| | MCALESTER | .91 |
| | OKLAHOMA CITY | .98 |
| | ALTUS AFB | .94 |
| | ENID | 1.01 |
| | MCALESTER AAP | .91 |
| | FORT SILL | .90 |
| Oregon | STATE AVERAGE | 1.05 |
| | PENDLETON | 1.08 |
| | PORTLAND | 1.07 |
| | SALEM | .99 |

CONUS INSTALLATIONS
AREA COST FACTOR INDEXES

| STATE | LOCATION | ACF INDEX |
|---|---|---|
| Oregon | CHARLESTON | 1.11 |
| | COOS HEAD | 1.08 |
| | UMATILLA ARMY DEPOT | 1.18 |
| Pennsylvania | STATE AVERAGE | 1.00 |
| | HARRISBURG | .91 |
| | PHILADELPHIA | 1.05 |
| | PITTSBURGH | 1.04 |
| | CARLISLE BARRACKS | .93 |
| | NEW CUMBERLAND ARMY DEPOT | .91 |
| | FORT INDIANTOWN GAP | 1.07 |
| | LETTERKENNY ARMY DEPOT | 1.07 |
| | MECHCANICSBURG AREA | .91 |
| | TOBYHANNA ARMY DEPOT | 1.14 |
| | WARMINSTER AREA | 1.04 |
| Rhode Island | STATE AVERAGE | 1.11 |
| | BRISTOL | 1.13 |
| | NEWPORT | 1.11 |
| | PROVIDENCE | 1.10 |
| | DAVISVILLE | 1.17 |
| South Carolina | STATE AVERAGE | .82 |
| | CHARLESTON | .81 |
| | COLUMBIA | .82 |
| | MYRTLE BEACH | .84 |
| | BEAUFORT AREA | .89 |
| | CHARLESTON AFB | .81 |
| | FORT JACKSON | .82 |
| | SUMTER | .80 |
| South Dakota | STATE AVERAGE | .95 |
| | ABERDEEN | .95 |
| | SIOUX FALLS | .94 |
| | RAPID CITY | .96 |
| | ELLSWORTH AFB | .98 |
| Tennessee | STATE AVERAGE | .84 |
| | CHATTANOOGA | .86 |
| | KINGSPORT | .72 |
| | MEMPHIS | .95 |
| | ARNOLD AFB | .90 |
| | MILAN AAP | .98 |
| | HOLSTON AAP | .71 |
| Texas | STATE AVERAGE | .85 |
| | SAN ANGELO | .76 |
| | SAN ANTONIO | .86 |
| | FORT WORTH | .93 |
| | FORT BLISS | .96 |
| | CARSWELL AFB | .93 |
| | CHASE FIELD - BEEVILLE | .97 |
| | CORPUS CHRISTI ARMY DEPOT | .92 |
| | CORPUS CHRISTI | .92 |

## CONUS INSTALLATIONS
## AREA COST FACTOR INDEXES

| STATE | LOCATION | ACF INDEX |
|---|---|---|
| Texas | DALLAS | .93 |
| | DYESS AFB | .94 |
| | FORT HOOD | .89 |
| | KINGSVILLE | .99 |
| | RED RIVER ARMY DEPOT | .78 |
| | FORT SAM HOUSTON | .86 |
| | WILLIAM BEAUMONT AMC | .96 |
| | BERGSTROM AFB | .95 |
| | BROOKS AFB | .86 |
| | RANDOLPH AFB | .86 |
| | KELLY AFB | .86 |
| | LACKLAND AFB | .86 |
| Utah | STATE AVERAGE | 1.03 |
| | OGDEN | 1.05 |
| | SALT LAKE CITY | 1.00 |
| | TOOELE | 1.05 |
| | DUGWAY PROVING GROUND | 1.03 |
| | HILL AFB | 1.07 |
| | TOOELE ARMY DEPOT | 1.05 |
| Vermont | STATE AVERAGE | .99 |
| | BURLINGTON | 1.00 |
| | MONTPELIER | 1.00 |
| | RUTLAND | .96 |
| Virginia | STATE AVERAGE | .95 |
| | NORFOLK | .95 |
| | RADFORD | .95 |
| | RICHMOND | .94 |
| | ARLINGTON | 1.04 |
| | ARLINGTON HALL STATION | 1.04 |
| | ARLINGTON NATIONAL CEMETERY | 1.04 |
| | FORT BELVOIR | 1.04 |
| | CAMERON STATION | 1.04 |
| | DAHLGREN | 1.10 |
| | FORT EUSTIS | .96 |
| | HUMPHREYS ENGINEER CENTER | 1.03 |
| | FORT A P HILL | .92 |
| | FORT LEE | .93 |
| | FORT MONROE | .94 |
| | FORT MYER | 1.03 |
| | NORFOLK-NEWPORT NEWS AREA | .95 |
| | FORT PICKETT | .98 |
| | QUANTICO | 1.03 |
| | RADFORD AAP | 1.02 |
| | FORT STORY | .95 |
| | VINT HILL FARMS STATION | 1.03 |
| Washington | STATE AVERAGE | 1.09 |
| | SPOKANE | 1.08 |
| | TOCOMA | 1.07 |

CONUS INSTALLATIONS
AREA COST FACTOR INDEXES

| STATE | LOCATION | ACF INDEX |
|---|---|---|
| Washington | YAKIMA | 1.11 |
| | FAIRCHILD AFB | 1.13 |
| | JIM CREEK | 1.34 |
| | FORT LEWIS | 1.07 |
| | PACIFIC BEACH | 1.27 |
| | PUGET SOUND AREA | 1.15 |
| | SEATTLE AREA | 1.12 |
| | WHIDBEY ISLAND | 1.12 |
| | YAKIMA FIRING CENTER | 1.18 |
| West Virginia | STATE AVERAGE | .95 |
| | BLUEFIELD | .92 |
| | CLARKSBURG | .95 |
| | CHARLESTON | .99 |
| | SUGAR GROVE | 1.15 |
| Wisconsin | STATE AVERAGE | 1.06 |
| | LACROSSE | 1.04 |
| | MADISON | 1.02 |
| | MILWAUKEE | 1.13 |
| | BADGER AAP | 1.06 |
| | CLAM LAKE | 1.20 |
| | FORT MCCOY | 1.11 |
| Wyoming | STATE AVERAGE | 1.08 |
| | CASPER | 1.07 |
| | CHEYENNE | 1.10 |
| | LARAMIE | 1.08 |
| | F E WARREN AFB | 1.10 |

## APPENDIX B:

## TECHNICAL AND PROGRAM SPECIFICATIONS

### Language Specifics

Compiler -- Microsoft C compiled for:

- -- huge memory model
- -- optimized for size
- -- reduce register calls.

Microsoft C is a full development package for the IBM-PC environment. However, ESTER 1.0 uses few nonstandard functions, and those that aren't in the K&R standard are common extensions found in many 'C' compiler packages. Turbo C will compile each module properly, but runs into trouble linking the source modules correctly. This is due to Turbo C's present incapability of redefining global variables. (This could be overcome by combining all the modules into one, but the source files would be so large that required memory needed just for merging would be extensive.)

The variables are global due to the many variable calls throughout the program and, perhaps more importantly, due to the time limitations. Though this solution may not be the best, it works. Future ESTER enhancements may address this situation and determine that the variables may be passed directly to the functions as structure parameters. This method would extend the program expansion and enhancement options available to the programmer, and would further increase ESTER's viability in meeting Army policy regarding TWBs. Some ideas regarding future ESTER augmentations include:

- A detailed breakdown of each cost into material, labor, equipment, and total costs, including overhead and profit.
- Reading the unit defines from disk, in conjunction with a utility program that would allow the user to update unit costs. This would free up more computer memory, and eliminate the need for recompilation after cost updates.
- Including user adjusted Cost Adjustment Factors within the program itself, following the same parameters as the previous enhancement.
- Adding more unit defines within the program, allowing a broader user base--to include a permanent and semi-permanent buildings database.
- Other miscellaneous enhancements might include
  - -- a duplicate file name check within the file save function
  - -- a method of reading previously determined demolition and rehabilitation costs directly from a file into the program
  - -- a window environment and cursor control.

**Source Code Specifics**

The basic format in psuedocode is as follows:

```
Write out options available to user
  get user input
    if user input not an option do
      write out error message
      return to get user input
    else do what user chose
```

An example, in formal code, is:

```
example( )
        {
        do
        {
        printf("\033[2J");      (* this is an escape code recognized by the PC world as a
                                   clear screen and set cursor at upper left on the screen
                                   -- this is used throughout the program. Causes a bit of a
                                   problem, because too many calls will result in a stack
                                   overflow during the program startup *)
        format( );              (* this function is defined in the respective "main" source
                                   to space down a few lines *)

        printf("\tExample code section options:\n\n");
        printf("\t\t<1> Option one.\n");
        printf("\t\t<2> Option two.\n");
        printf("\t\t<3> Option three.\n\n");
        printf("\t\t<E> Exit example code.\n\n\n\n");
        do
        {
                                (* This routine asks for the option choice, and then
                                   converts the character to upper case -- with unbuffered
                                   input *)
             printf("Select option: ");
             ch = toupper(getche( ));
             printf("\n");
        }                       (* here we check that the keypress is valid. If not, do loop
                                   again, until keypress is valid choice *)
        while (ch < '1' || ch > '2' && ch != 'E');
                                (* now we've got our valid character, a switch routine is
                                   used to transfer control to the appropriate funtcion *)
        switch(ch)
        {
        case '1':
             option_one( );
             break;
        case '2':
             option_two( );
             break;
        case '3':
             option_three( );
             break;
```

```
        case 'E':
             printf("\033[2J");
             exit(0);
        }
                                (* this will be looped until the user wishes to exit from the
                                   example code program, which in this instance is a bit
                                   silly due to the fact that the program will terminate
                                   before routine can evaluate for character 'E' *)
        } while (ch != 'E');
}                               (* end example( ) *)
```

An attempt was made to ensure code simplicity as an aid to programmers who wish to change the basic source code it with a minimum of disruption. There are a few other routines that need clarification. The functions getint( ) and getnum( ) check that the entered data is an integer value, and then pass the entered value as a parameter back to the calling routine. Also, in the driver code portion, a 'C' extension, spawnl( ), is used to pass ASCII characters as parameters to a child process, keeping the calling, or parent process, on hold.

### Header Files

The header files (Appendix C) detail the prices and units used to determine rehabilitation costs. To change the values used within the program, it is necessary to redefine the values in these header files, and then recompile the program. This is not difficult, but requires access to a capable compiler. To avoid having to issue updates each year, it will eventually become necessary to create a small program that will allow the user to update his own data and then load these updated figures into the program.

## APPENDIX C:

## HEADER DATA FILES: DEMOLITION AND REHABILITATION

```
/* This section contains the header file data required to determine */
/*   demolition costs associated with World War II */
/*   temporary buildings. The data (at this time) is compiled from  */
/*   Means Construction Cost Data and Means Repair and Remodeling   */
/*   Cost Data for 1987  */

/* Demolition Costs for related renovation */

/* Structure */

/* Floors, concrete slab on grade */
#define FOUNDTN_4  2.40        /* SF. 4" thick, plain concrete */
#define FOUNDTN_6  3.03        /* SF. 6" thick, plain concrete */
#define FOUNDTN_4R 2.55        /* SF. 4" thick, wire reinforced */
#define FOUNDTN_6R 3.53        /* SF. 6" thick, wire reinforced */

/* Footings, concrete */
#define FOOTNGS_1  8.80        /* LF. 1' thick, 2' wide */
#define FOOTNGS_2 10.55        /* LF. 1'-6" thick, 2' wide */
#define FOOTNGS_3 13.20        /* LF.            3' wide */
#define FOOTNGS_4 15.05        /* LF. 2' thick, 3' wide */

/* Framing demolition */
#define JOISTS_4   0.40        /* LF. Joists, 2" x 4" */
#define JOISTS_8   0.43        /* LF.         2" x 8" */
#define JOISTS_12  0.46        /* LF.         2" x 12" */
#define BEAMS_8    3.77        /* LF. Wood framing, beams, 6" x 8" */
#define BEAMS_10   4.71        /* LF.                     6" x 10" */
#define BEAMS_12   5.60        /* LF.                     6" x 12" */
#define BEAMS8X12  7.40        /* LF.                     8" x 12" */
#define BEAMS10X12 9.45        /* LF.                     10" x 12" */
#define HEADER_6   1.84        /* LF. Wood headers over openings, 2 @ 2" x 6" */
#define HEADER_8   2.02        /* LF.                       2 @ 2" x 8" */
#define HEADER_10  2.25        /* LF.                       2 @ 2" x 10" */
#define RAFTER_6   0.48        /* LF. Wood rafters, ordinary, 2" x 6" */
#define RAFTER_8   0.56        /* LF.                    2" x 8" */
#define H_V_RFTR_6 0.81        /* LF.              hip and valley, 2" x 6" */
#define H_V_RFTR_8 0.96        /* LF.                              2" x 8" */
#define EXTSTDS_4  0.20        /* LF. Wood studs, 2" x 4" */
#define EXTSTDS_6  0.25        /* LF.             2" x 6" */
#define STAIRS    12.825       /* /riser Wood stairs and stringers, average */

/* interior gutting costs */

#define GUT_LO     2.87        /* SF. Gutting residential building interior, including disposal, minimum */
#define GUT_HI     3.19        /* SF.                                                            maximum */

/* building demolition, Wood  */

#define DEMOL_WD   0.17        /* CF. Small bldgs., or single bldgs., no salvage included */

/* siding demolition */

#define METAL_H    0.67        /* SF. Siding, metal, horizontal */
#define METAL_V    0.72        /* SF.                vertical */
#define WOOD_H     0.78        /* SF.         wood, horizontal */
#define WOOD_V     0.72        /* SF.              vertical */
#define WOOD_SHNGL 0.81        /* SF.         wood, shingles */
#define PLY_SIDE   0.40        /* SF.         wood, textured plywood */
```

```
 * ceiling demolition */

#define DRYWALL_W  0.51        /* SF. Drywall on wood frame */
#define DRYWALL_M  0.53        /* SF. Drywall on metal frame */
#define DRYWALL_S  0.56        /* SF. Drywall on suspension frame, including system */
#define TILE_GLU   0.45        /* SF. Tile, wood fiber, 12" x 12", glued */
#define TILE_STPL  0.40        /* SF.                              stapled */
#define TILE_SUSP  0.53        /* SF.                              on suspension system, including system */
#define PLYWD_4X8  0.34        /* SF. Plywood, or wood fiberboard, 4' x 8' sheets */
#define WOOD_TG1X4 0.40        /* SF. Wood, Tongue and groove, 1" x 4" */
#define WOOD_TG1X8 0.37        /* SF.                          1" x 8" */

 * door demolition */

#define DOR_RESET  37.50       /* EA. Remove and reset costs per door, averaged */
#define DOOR_EXTD  16.85       /* EA. Double door demolition, exterior */
#define DOOR_INTD  12.65       /* EA.                         interior */
#define DOOR_EXT   12.65       /* EA. Single door demolition, exterior */
#define DOOR_INT   10.10       /* EA.                         interior */
#define TRIM_MTL   31.00       /* EA. Frames, including trim, metal */
#define TRIM_WOOD  17.60       /* EA.                         wood */

 * window demolition */

#define WINDOW_12  12.65       /* EA. Wood window demolition, including trim, to 12 sf. */
#define WINDOW_25  16.85       /* EA.                                        to 25 sf. */
#define WINDOW_50  34.00       /* EA.                                        to 50 sf. */
#define WND_RESET  65.00       /* EA. Remove and reset window, average */

/* flooring demolition */

#define FLR_RES_S  0.29        /* SF. Resilient, sheet goods (linoleum) */
#define FLR_RES_T  0.40        /* SF.           tile, 12" x 12" */
#define FLR_CRP_B  0.20        /* SF. Carpet, bonded, including scraping */
#define FLR_CRP_T  0.04        /* SF.        tackless, including scraping */
#define FLR_CER_T  0.62        /* SF. Tile, ceramic, thin set */
#define FLR_CER_M  0.70        /* SF.               mud set */
#define FLR_CMP    1.23        /* SF. Composition */
#define SUBFLR_1X6 0.76        /* SF. Subfloor, tongue and groove, 1" x 6" */
#define SUBFLR_1X8 0.57        /* SF.                              1" x 8" */
#define SUBFLR_1X10 0.47       /* SF.                              1" x 10" */
#define SUBFLR_PLY  0.41       /* SF. Subfloor, plywood, nailed */
#define SUBFLR_GLU  0.62       /* SF.                    glued and nailed */

 * interior partitions demolition */

#define WALLS_DRYN 0.20        /* SF. Drywall, nailed */
#define WALLS_FBRN 0.22        /* SF. Fiberboard, nailed */
#define WALLS_DRYGN 0.22       /* SF. Drywall, nailed and glued */
#define WALLS_FBRGN 0.25       /* SF. Fiberboard, nailed and glued */
#define WALLS_MTLF   1.22      /* SF. Metal or wood studs, finished 2 sides, fiberboard */
#define WALLS_MTLD   1.22      * SF.                                        drywall */
#define WALLS_MTLM5  0.67      /* SF. Moveable wall, metal, to 5' high */
#define WALLS_MTLM8  0.51      /* SF.                       to 8' high */

 * roofing demolition */

#define RF_INSUL  0.27         /* SF. Roof insulation board */
#define RFDECK_CON 1.17        * SF. Roof deck, concrete plank */
#define RFDECK_GYP 0.50        /* SF.           gypsum plank */
```

```
#define RFDECK_S6  0.44        /* SF. Roof deck, wood, standard planks, 1" x 6" */
#define RFDECK_S8  0.41        /* SF.                                   1" x 8" */
#define RFDECK_S12 0.40        /* SF.                                   1" x 12" */
#define RFDECK_TG6 0.50        /* SF.                tongue and groove, 2" x 6" */
#define RFDECK_TG9 0.46        /* SF.                                  2" x 10" */
#define SHINGLE_A 0.30         /* SF. Shingles, asphalt strip */
#define SHINGLE_S 0.41         /* SF.           slate */
#define SHINGLE_W 0.47         /* SF.           wood */
#define BU_5PLY   0.65         /* SF. Roofing, built-up, 5 ply, no gravel */
#define GUTTERS   1.01         /* LF. Gutters, aluminum or wood, edge hung */
#define RF_ACCS  14.45         /* EA. Roof accessories, plumbing vent flashing */

/* electrical demolition */

/* Conduit to 15' high, including fittings and hangers */
#define COND_STL_1    1.12     /* LF. Rigid galvanized steel, 1/2" to 1" diameter */
#define COND_STL_2    1.36     /* LF.                         1-1/4" to 2" diameter */
#define COND_STL_4    1.80     /* LF.                         2" to 4" diameter */
#define COND_EMT_1    0.69     /* LF. Electric metallic tubing, 1/2" to 1" diameter */
#define COND_EMT_2    0.83     /* LF.                           1-1/4" to 1-1/2" diameter */
#define COND_EMT_3    1.15     /* LF.                           2" to 3" diameter */

/* Panel boards, incl. removal of all breakers, pipe */
/* terminations, and wire connectors */
#define PNL_BRDS_1  105.00     /* EA. 3 wire, 120/240V, 100 amps, to 20 circuits */
#define PNL_BRDS_2  210.00     /* EA.                   200 amps, to 42 circuits */
#define PNL_BRDS_3  115.00     /* EA. 4 wire, 120/208V, 125 amps, to 20 circuits */
#define PNL_BRDS_4  225.00     /* EA.                   200 amps, to 42 circuits */

/* Interior flourescent fixtures, including supports */
/* and whips, to 15' high */
#define SRFC_2F_1X4  12.35     /* EA. Surface mounted, acrylic lens, and hinged frame, 1' x 4', 2 lamp */
#define SRFC_2F_2X2  12.35     /* EA.                                                  2' x 4', 2 lamp */
#define SRFC_4F_2X4  16.40     /* EA.                                                  2' x 4', 4 lamp */
#define SRFC_4F_4X4  24.00     /* EA.                                                  4' x 4', 4 lamp */
#define DROP_2F_2X2  15.35     /* EA. Recessed drop-in, 2' x 2', 2 lamp */
#define DROP_2F_2X4  16.40     /* EA.                   2' x 4', 2 lamp */
#define DROP_4F_2X4  18.50     /* EA.                   2' x 4', 4 lamp */
#define DROP_4F_4X4  28.00     /* EA.                   4' x 4', 4 lamp */
#define STRP_1F_4    10.20     /* EA. Strip fixtures, surface mounted, 4' long, 1 lamp */
#define STRP_2F_4    10.80     /* EA.                                  2 lamp */
#define STRP_1F_8    12.90     /* EA.                          8' long, 1 lamp */
#define STRP_2F_8    13.85     /* EA.                                  2 lamp */

/* Pendant mounted flourescent lamps, industrial, including */
/* removal of chain or rod hangers, to 15' high */
#define PNDT_2F_4    15.35     /* EA. 4' long, 2 lamp */
#define PNDT_2F_8    20.00     /* EA. 8' long, 2 lamp */

/* Interior incandescent, surface, ceiling or wall mount, to 12' high */
#define INCAN_75      8.70     /* EA. Metal cylinder type, 75 watt */
#define INCAN_150     8.70     /* EA.                      150 watt */
#define INCAN_150MH  27.00     /* EA. Metal halide, low bay, 150 watt */

/* Exterior fixtures, incandescent, wall mount */
#define XLITE_100    10.90     /* EA. 100 watt */
#define XLITE_175    22.00     /* EA. Wall pack, mercury vapor, 175 watt */
#define XLITE_250    22.00     /* EA.                           250 watt */

/* Pull boxes and cabinets, sheet metal, includes removal */
```

```
 * of supports and pipe terminations */
#define BOX_6_6       8.75      /* EA. 6" x 6" x 4" */
#define BOX_12_12    11.65      /* EA. 12" x 12" x 4" */
#define BOX_JNCTN     3.40      /* EA. Junction boxes, 4" square and octaganol */
#define BOX_SWTCH     2.54      /* EA. Switch box */
#define BOX_RCPTCL    1.06      /* EA. Receptacle and switch plates */

/* Safety switches, 250 or 600V, including disconnection of */
/* wire and pipe terminations */
#define SWTCHS_30    22.00      /* EA. 30 amp */
#define SWTCHS_60    31.00      /* EA. 60 amp */
#define SWTCHS_100   37.00      /* EA. 100 amp */
#define SWTCHS_200   54.00      /* EA. 200 amp */

 * heating, ventilation, cooling demolition */

#define BOILER_G1   265.00      /* EA. Boiler, gas or oil, steel, under 150 MBH */
#define BOILER_G2   395.00      /* EA.                            over 150 MBH */
#define FURNAC_G1   125.00      /* EA. Furnace, gas or oil, under 120 MBH */
#define FURNAC_G2   170.00      /* EA.                      over 120 MBH */
#define BOILER_E    390.00      /* EA. Boiler, electric */
#define FURNAC_E    320.00      /* EA. Furnace, electric */
#define DUCT_6X8      1.23      /* LF. Ductwork, 6" high x 8" wide */
#define DUCT_6X12     1.35      /* LF.                   12" wide */
#define DUCT_6X18     1.50      /* LF.                   18" wide */
#define DUCT_10X12    1.62      /* LF.          10" high x 12" wide */
#define DUCT_10X18    1.76      /* LF.                    18" wide */
#define DUCT_10X24    1.84      /* LF.                    24" wide */
#define DUCT_12X18    2.38      /* LF.          12" high x 18" wide */
#define DUCT_12X24    2.70      /* LF.                    24" wide */
#define DUCT_12X48    2.85      /* LF.                    48" wide */
#define MECH_EQU    565.00      /* TON  Mechanical equipment, light items */

/* plumbing demolition */

 * Fixtures, including 10' of piping */
#define WTR_CLSTF    35.00      /* EA. Water closet, floor mounted */
#define WTR_CLSTW    40.00      /* EA.              wall mounted */
#define LAVS_WH      28.00      /* EA. Lavatory, wall hung */
#define LAVS_CT      35.00      /* EA.          counter top */
#define SNGL_SINK    35.00      /* EA. Sink, steel or cast iron, single */
#define DBL_SINK     40.00      /* EA.                           double */
#define URINALSF     69.00      /* EA. Urinal, floor mounted */
#define URINALSW     40.00      /* EA.        wall mounted */
#define WTR_HTR_40   46.00      /* EA. Water heater, 40 gal. */
#define PIPNG_2       1.39      /* LF. Piping, metal, to 2" diameter */
#define PIPNG_4       1.85      /* LF.               to 4" diameter */
#define PIPNG_8       5.55      /* LF.               to 8" diameter */
#define PIPNG_16      9.25      /* LF.               to 16" diameter */
#define FXT_RESET    57.50      /* EA. Remove and reset fixtures, average cost */

 * moving buildings */

 * One day move, reset on new foundation, patch and hook-up */
#define MOVE_24       8.90      /* SF. ground floor, Wood or steel frame bldg., up to 24' wide */
#define MOVE_42      10.40      /* SF. ground floor, Wood or steel frame bldg., between 24' and 42' wide */
#define MOVE_COMP    22.00      /* SF. ground floor, Construct new basement, move building, patch & hook-up */
```

```
/* following costs deal with installation as determined    */
/*   by Means data--used in the program in conjuction with */
/*   demolition data. */

/* insulation installation */

/* blown in insulation */

#define BLO_C_R11  0.39        /* S.F., cellulose, R-11 */
#define BLO_C_R19  0.61        /* S.F., cellulose, R-19 */
#define BLO_C_R22  0.76        /* S.F., cellulose, R-22 */
#define BLO_F_R11  0.54        /* S.F., fiberglass, R-11 */
#define BLO_F_R13  0.68        /* S.F., fiberglass, R-13 */
#define BLO_F_R19  0.91        /* S.F., fiberglass, R-19 */
#define BLO_M_R11  0.54        /* S.F., mineral wool, R-11 */
#define BLO_M_R13  0.81        /* S.F., mineral wool, R-13 */
#define BLO_M_R19  1.16        /* S.F., mineral wool, R-19 */
#define BLO_C_R26  0.91        /* S.F., cellulose, R-26 */
#define BLO_F_R26  1.38        /* S.F., fiberglass, R-26 */
#define BLO_F_R22  1.14        /* S.F., fiberglass, R-22 */
#define BLO_HOLE_M  1.87       /* per S.F., wall installation, masonry */
#define BLO_HOLE_W  0.93       /* per S.F., wall installation, wood siding */
#define BLO_HOLE_S  1.17       /* per S.F., wall installation, stucco/plaster */

/* floor insulation, blankets or batts, paper or foil backing */
/* non rigid (hangers included) */

#define FBR_BATT_R11  0.59             /* S.F., fiberglass, 3.5" thick, R-11 */
#define FBR_BATT_R19  0.78             /* S.F., fiberglass, 6" thick, R-19 */
#define FBR_BATT_R30  0.98             /* S.F., fiberglass, 8.5" thick, R-30 */

 * wall or ceiling insulation, non rigid */

 * fiberglass, kraft faced, 3.5" thick, R-11 */
#define FBR_11_R11   0.44              /* S.F., 11" wide, R-11 */
#define FBR_15_R11   0.38              /* S.F., 15" wide, R-11  */
#define FBR_23_R11   0.40              /* S.F., 23" wide, R-11  */

 * fiberglass, kraft faced, 6" thick, R-19 */
#define FBR_11_R19   0.61              /* S.F., 11" wide */
#define FBR_15_R19   0.54              /* S.F., 15" wide  */
#define FBR_23_R19   0.51              /* S.F., 23" wide  */

/* fiberglass, kraft faced, 9" thick, R-30 */
#define FBR_15_R30   0.77              /* S.F., 15" wide */
#define FBR_23_R30   0.74              /* S.F., 30" wide */
```

```
 * fiberglass, foil faced, 3.5" thick */
#define FCD_15_R11   0.40              /* S.F. */
#define FCD_23_R11   0.40              /* S.F. */

 * fiberglass, foil faced, 6" thick */
#define FCD_15_R19   0.57              /* S.F. */
#define FCD_23_R19   0.54              /* S.F. */

 * fiberglass, foil faced, 9" thick */
#define FCD_15_R30   0.81              /* S.F. */
#define FCD_23_R30   0.77              /* S.F. */

 * fiberglass, unfaced, 3.5" thick */
#define UNFCD_15_R11  0.39             /* S.F. */
#define UNFCD_23_R11  0.36             /* S.F. */


 * fiberglass, unfaced, 6" thick */
#define UNFCD_15_R19  0.55             /* S.F. */
#define UNFCD_23_R19  0.52             /* S.F. */

 * fiberglass, unfaced, 9" thick */
#define UNFCD_15_R30  0.79             /* S.F. */
#define UNFCD_23_R30  0.75             /* S.F. */

 * mineral fiber, kraft faced */
#define MINERAL_R13  0.41              /* S.F., 3.5" thick */
#define MINERAL_R19  0.60              /* S.F., 6" thick */
#define MINERAL_R30  0.93              /* S.F., 10" thick */

 * wall insulation, rigid */

 * fiberglass, 1.5#/cf, unfaced */
#define RGD_FBR4_1  0.46               /* S.F., 1" thick, R-4.1 */
#define RGD_FBR6_2  0.64               /* S.F., 1.5" thick, R-6.2 */
#define RGD_FBR8_3  0.76               /* S.F., 2" thick, R-8.3 */

 * fiberglass, 3#/cf, unfaced */
#define RGD_3FBR4_3  0.81              /* S.F., 1" thick, R-4.3 */
#define RGD_3FBR6_5  1.08              /* S.F., 1.5" thick, R-6.5 */
#define RGD_3FBR8_7  1.40              /* S.F., 2" thick, R-8.7 */

 * fiberglass, 6#/cf, unfaced */
#define RGD_6FBR4_3  1.26              /* S.F., 1" thick, R-4.3 */
#define RGD_6FBR6_5  1.80              /* S.F., 1.5" thick, R-6.5 */
#define RGD_6FBR8_7  2.32              /* S.F., 2" thick, R-8.7 */

 * fiberglass, 3# cf, foil faced */
#define RGD_3FBRF4_3  1.29             /* S.F., 1" thick, R-4.3 */
#define RGD_3FBRF6_5  1.56             /* S.F., 1.5" thick, R-6.5 */
#define RGD_3FBRF8_7  1.86             /* S.F., 2" thick, R-8.7 */

 *  fiberglass, 6#/cf, foil faced */
#define RGD_6FBRF4_3  1.71             /* S.F., 1" thick, R-4.3 */
#define RGD_6FBRF6_5  2.23             /* S.F., 1.5" thick, R-6.5 */
#define RGD_6FBRF8_7  2.75             /* S.F., 2" thick, R-8.7 */

#define RGD_FOAM1     1.88             /* S.F., foamglass, 1.5" thick, R-2.64 */
#define RGD_FOAM2     2.53             /* S.F., foamglass, 2" thick, R-5.26 */
#define RGD_PERL1     0.63              * S.F., perlite, 1" thick, R-2.77 */
```

```
#define RGD_PERL2     0.97            /* S.F., perlite, 2" thick, R-5.55 */

/* polystyrene, extruded blue, 2.2#/cf */
#define RGD_BPOLY4    0.72            /* S.F., 3/4" thick, R-4 */
#define RGD_BPOLY8_1  1.00            /* S.F., 1" thick, R-8.1 */
#define RGD_BPOLY10_8 1.21            /* S.F., 2" thick, R-10.8 */

/* polystyrene, molded bead board, white, 2.2#/cf */
#define RGD_WPOLY7_7  0.69            /* S.F., 2" thick, R-7.7 */
#define RGD_WPOLY5_6  0.61            /* S.F., 1.5" thick, R-5.6 */
#define RGD_WPOLY3_85 0.49            /* S.F., 1" thick, R-3.85 */

/* roof deck insulation */

/* fiberglass, in 3'x4' or 4'x8' sheets */
#define FBRGLS_R3_3   0.67            /* S.F., 15/16" thick, R-3.3 */
#define FBRGLS_R3_8   0.73            /* S.F., 1-1/16" thick, R-3.8 */
#define FBRGLS_R5_3   0.86            /* S.F., 1-5/16" thick, R-5.3 */
#define FBRGLS_R5_7   0.97            /* S.F., 1-5/8" thick, R-5.7 */
#define FBRGLS_R7_7   1.00            /* S.F., 1-7/8" thick, R-7.7 */

/* fiberboard, mineral */
#define FBRBRD_R2_78  0.59            /* S.F., 1" thick, R-2.78 */
#define FBRBRD_R4     0.78            /* S.F., 1.5" thick, R-4 */
#define FBRBRD_R5_26  0.92            /* S.F., 2" thick, R-5.26 */

/* fiberglass and urethane composite, 3'x4' sheets */
#define FBRCOMP_R11_1 0.90            /* S.F., 1-11/16" thick, R-11.1 */
#define FBRCOMP_R14_3 1.08            /* S.F., 2" thick, R-14.3 */
#define FBRCOMP_R18_2 1.26            /* S.F., 2-5/8" thick,  R-18.2 */

/* foamglass, 2'x4' sheets, rectangular */
#define FOAMGLS_R3_95 1.97            /* S.F., 1.5" thick, R-3.95 */
#define FOAMGLS_R5_26 2.41            /* S.F., 2" thick, R-5.26 */
#define FOAMGLS_R7_89 2.84            /* S.F., 3" thick, R-7.89 */
#define FOAMGLS_R10_53 4.87           /* S.F., 4" thick, R-10.53 */

/* perlite, 2'x4' sheets */
#define PERLITE_R2_08 0.55            /* S.F., 3/4" thick, R-2.08 */
#define PERLITE_R2_78 0.63            /* S.F., 1" thick, R-2.78 */
#define PERLITE_R4_17 0.78            /* S.F., 1.5" thick, R-4.17 */
#define PERLITE_R5_26 0.98            /* S.F., 2" thick, R-5.26 */

/* phenolic foam, 4'x8' sheets */
#define PHENOL_R10    0.69            /* S.F., 1-3/16" thick, R-10 */
#define PHENOL_R12_5  0.80            /* S.F., 1.5" thick, R-12.5 */
#define PHENOL_R14_6  0.88            /* S.F., 1.75" thick, R-14.6 */
#define PHENOL_R16_7  1.04            /* S.F., 2" thick, R-16.7 */
#define PHENOL_R20    1.17            /* S.F., 2.5" thick, R-20 */

/* polystyrene, 2.3#/cf */
#define POLY_R5_26    0.49            /* S.F., extruded, 1" thick, R-5.26 */
#define POLY_R10      0.83            /* S.F., extruded, 2" thick, R-10 */
#define POLY_R15      1.20            /* S.F., extruded, 3" thick, R-15 */
#define POLY_R3_57    0.30            /* S.F., expanded bead, 1" thick, R-3.57 */
#define POLY_R7_14    0.47            /* S.F., expanded bead, 2" thick, R-7.14 */

/* urethane and gypsum board composite */
#define URE_GYP_R7_7  1.11            /* S.F., 1-5/8" thick, R-7.7 */
#define URE_GYP_R10   1.42            /* S.F., 2" thick,  R-10 */
```

```
#define URE_GYP_R14_3 1.53              /* S.F., 2.5" thick, R-14.3 */
#define URE_GYP_R18_2 1.59              /* S.F., 3" thick, R-18.2 */

 * urethane, felt both sides */
#define URE_R6_7      0.75              /* S.F., 1" thick, R-6.7 */
#define URE_R11_11    0.87              /* S.F., 1.5" thick, R-11.11 */
#define URE_R14_3     0.99              /* S.F., 2" thick, R-14.3 */
#define URE_R20       1.14              /* S.F., 2.5" thick, R-20 */
#define URE_R25       1.29              /* S.F., 3" thick, R-25 */


 * roofing installation */

#define VENT_REHAB 33.00        /* E.A., average roof vent installation cost */
#define SHNGL_1   0.80          /* S.F., standard asphalt, inorganic, class A */
#define SHNGL_2   0.85          /* S.F., organic, class C */
#define SHNGL_3   1.15          /* S.F., multi-layered, class A */
#define SHNGL_4   1.20          /* S.F., multi-layered, class C */
#define SHNGL_5   1.60          /* S.F., premium, multi-layered, class A */
#define SHNGL_6   1.70          /* S.F., premium, multi-layered, class C */
#define FELT_1    0.0935        /* S.F., glass fibered, #15, no mop */
#define FELT_2    0.1155        /* S.F., glass fibered, #43, base sheet */
#define FELT_3    0.075         /* S.F., asphalt felt, #15, no mop */
#define FELT_4    0.1055        /* S.F., asphalt felt, #30, 2 sq/roll */
#define FELT_5    0.0975        /* S.F., tarred felt, organic, #15 */
#define FELT_6    0.1510        /* S.F., tarred felt, organic, #30 */
#define MOPPING   0.1180        /* S.F., additional for mopping above felts */

 * aluminum flashing, mill  finish */
#define FLSHNG_13  2.24         /* S.F., .013" thick */
#define FLSHNG_16  2.29         /* S.F., .016" thick */
#define FLSHNG_19  2.64         /* S.F., .019" thick */
#define FLSHNG_32  2.79         /* S.F., .032" thick */
#define FLSHNG_40  3.37         /* S.F., .040" thick */
#define FLSHNG_50  3.70         /* S.F., .050" thick */

 * aluminum gutters, stock units */
#define GUTTR_AL_1 3.40         /* L.F., 5" box, .027" thick, plain */
#define GUTTR_AL_2 3.62         /* L.F., 5" box, .032" thick, plain */
 * stainless steel gutters */
#define GUTTR_SS_4 7.10         /* L.F., half round or box, 4" wide */
#define GUTTR_SS_5 7.40         /* L.F., half round or box, 5" wide */
 * galvanized steel gutters */
#define GUTTR_GS_1 3.07         /* L.F., half round or box, 28 ga. 5" wide, plain */
#define GUTTR_GS_2 3.21         /* L.F., half round or box, 26 ga. 5" wide */

#define SHTNG_CP   5.30         /* SF. cedar plank roof deck, 3" thick */
#define SHTNG_DF   4.39         /* SF. douglas fir roof deck, 3" thick */
#define SHTNG_H    4.29         /* SF. Hemlock roof deck, 3" thick */
#define SHTNG_CDX_1 0.67        /* SF. plywood, CDX, 5/16 thick */
#define SHTNG_CDX_2 0.72        /* SF. 3/8 thick */
#define SHTNG_CDX_3 0.86        /* SF. 1/2 thick */
#define SHTNG_CDX_4 0.93        /* SF. 5/8 thick */
#define SHTNG_1X6   1.67        /* SF. 1x6 boards, horizontal */
#define SHTNG_1X6_D 1.76        /* SF. 1x6, diagonal */
#define SHTNG_1X8   1.54        /* SF. 1x8 boards, horizontal */
#define SHTNG_1X8_D 1.67        /* SF. 1x8 boards, diagonal */

 * downspouts *
#define DWNSPT_AL_1 2.03        /* L.F., Aluminum, 2x3, .020 thick, embossed */
```

```
#define DWNSPT_AL_2 2.01        /* L.F., Aluminum, 2x3, .024 thick, enameled */
#define DWNSPT_GS_1 1.98        * L.F., Galvanized, 2x3, 28 ga., corrugated */
#define DWNSPT_GS_2 3.34        /* L.F., Galvanized, 3x4, 28 ga., corrugated */

 * door replacement, flush */
 * doors are assumed to be 3'-0" wide, 6-8" to 7-0" high */

#define EXT_DOOR_WD   165.00    /* EA. Ext. flush, solid, flush, birch 1-3/4" x 7' x 3' */
#define EXT_DOOR_MTL  170.00    /* EA. Comm. steel, 20 ga., hollow, flush, full panel, 1-3/4" x 3' x 6'8" */
#define EXT_DOOR_MTL1 215.00    /* EA. Fire door, steel, 20 ga., flush, "B" label, 90 min., 3' x 6'8" */
#define EXT_DOOR_MTL2 230.00    /* EA. Composite, 20 ga., flush, "B" label, 90 min., 3' x 6'8" */
#define EXT_DOOR_MTL3 295.00    * EA.                          "A" label,         3' x 7' */
#define EXT_WD_F      175.00    /* EA. Wood, "B" label, 1 hour, birch face */
#define EXT_WD_S      160.00    /* EA. Wood, birch, solid core, 1-3/4" thick */
#define INT_STL_2_6   155.00    /* EA. Steel, hollow core, 1-3/8" x 2'6" x 6'8", 20 ga */
#define INT_FRE_2_6   195.00    * EA. Steel, "B" label, 90 min., 2'6" x 6'8", 20 ga */
#define WD_FRE_2_6    140.00    /* EA. Wood, "B" label, 1 hr., birch face, 2'6" x 6'8" */
#define INT_PRE_2_6H   81.00    /* EA. Wood, interior, hollow, pre-hung, 1-3/8" x 2'6" x 6'8"*/
#define INT_PRE_2_6S 160.00     /* EA. Wood, interior, solid, pre-hung, birch, 2'6" x 6'8" */
#define INT_DOOR_LH   83.00     /* EA. Wood, int., 7 ply, hollow, flush, lauan face, arch., 3' x 6'8" */
#define INT_DOOR_BH   91.00     /* EA.                                birch face,                */
#define INT_DOOR_LS 110.00      * EA. Wood, int., 5 ply, particle core, flush, lauan face, 3' x 6'8" */
#define INT_DOOR_BS 125.00      /* EA.                                birch face,          */
#define INT_DOOR_BF 175.00      /* EA. Wood, 3 ply stile, "B" label, 1 hr., birch face, 3' x 7' */
#define INT_DOOR_OF 200.00      /* EA.                                oak face, 3' x 7' */

 * frames are taken at 17 l.f. per single door, 20 l.f. for double */

#define EXT_FRM_WDP    76.67    /* EA. exterior frame, pine frame, trim, 5-3/16" deep, single */
#define EXT_FRM_WDPD   90.20    /* EA. same, for double doors */
#define EXT_FRM_18     91.00    * EA. steel, knock down, single, 18 ga. */
#define EXT_FRM_18D   105.00    /* EA. steel, knock down, double, 18 ga. */
#define EXT_FRM_D18   100.00    /* EA. steel, drywall, single, 18 ga. */
#define EXT_FRM_D18D 115.00     * EA. steel, drywall, double, 18 ga. */
#define EXT_FRM_D16   110.00    * EA. steel, drywall, single, 16 ga. */
#define EXT_FRM_D16D 125.00     * EA. steel, drywall, double, 16 ga. */
#define EXT_FRM_WDO    90.10    /* EA. exterior frame, oak frame, trim, 5-3/16" deep, single */
#define EXT_FRM_WDOD 106.00     /* EA. same, for double doors */
#define INT_FRM_WP     51.34    /* EA. interior, pine frame, 11/16" x 4-9/16" deep */
#define INT_FRM_WO     59.16    * EA. interior, oak frame,                        */
#define INT_FRM_WPD    60.40    * EA. interior, pine frame, double, 11/16" x 4-9/86" deep */
#define INT_FRM_WOD    69.60    /* EA.          oak frame,                                */
#define WTHR_STRP_W    44.00    * EA. Avg. weather stripping, ext. wood door */
#define WTHR_STRP_M   250.00    /* EA. Avg. weather stripping, ext. metal door */

 * Door hardware is taken as a percentage within the program */
 *   again, these parameters are easily changed within the   */
 *   header file, and recompiled  */

#define EXT_HARD_P     1.00     * EA. Avg. 100% of each exterior door */
#define INT_HARD_P     0.10     /* EA. Avg. 10% of each interior door */
#define DOOR_PNT      76.80     * EA. Oilbase, primer, one coat, brush, both sides */

 * window replacement includes installation, frame, screen, and */
 * exterior trim. An option to remove and reset */
 * window within wall--defined in demolition section*/

 * double hung, average quality, wood */
#define DBI_WD_2X3    140.00    /* EA. insulating glass, 2' x 3' */
#define DB_WD_2X3     110.00    /* EA. standard glazed, 2' x'3' */
```

```
#define DBI_WD_3X4   165.00      * EA. insulating glass, 3' x 4' */
#define DB_WD_3X4    135.00      /* EA. standard glazed, 3' x 4' */
#define DBI_WD_4X4   180.00      /* EA. insulating glass, 4' x 4'6" */
#define DB_WD_4X4    160.00      * EA. standard glazed, 4' x 4'6" */

 * double hung, premium quality, plastic clad, wood core, insulating glass */
#define DB_PL_2X3    170.00      /* EA. 2'6" x 3' */
#define DB_PL_3X3    200.00      /* EA. 3' x 3'6" */
#define DB_PL_3X4    220.00      * EA. 3' x 4' */
#define DB_PL_3X4_6  230.00      /* EA. 3' x 4'6"*/
#define DB_PL_3X5    240.00      /* EA. 3' x 5' */
#define DB_PL_3X6    285.00      * EA. 3'6" x 6' */

 * double hung, deluxe quality, metal clad, wood core, insulating glass */
#define DB_MTL_2X3   205.00      /* EA. 2'6" x 3' */
#define DB_MTL_3X3   235.00      /* EA. 3' x 3'6" */
#define DB_MTL_3X4   255.00      /* EA. 3' x 4' */
#define DB_MTL_3X4_6 270.00      /* EA. 3' x 4'6" */
#define DB_MTL_3X5   315.00      /* EA. 3' x 5' */
#define DB_MTL_3X6   335.00      /* EA. 3'6" x 6' */

 * casement, average quality, bldrs. model, wood */
#define CS_WD_2X3    150.00      * EA. 2' x 3' high, standard glazed */
#define CS_WD_2X4    175.00      /* EA. 2' x 4'6" high, standard glazed */
#define CS_WD_2X6    230.00      * EA. 2' x 6' high, standard glazed */
#define CSI_WD_2X3   185.00      /* EA. 2' x 3' high, insulating glass */
#define CSI_WD_2X4   215.00      /* EA. 2' x 4'6" high, insulating glass */
#define CSI_WD_2X6   300.00      /* EA. 2' x 6' high, insulating glass */

 * casement, premium quality, plastic clad, wood core, insulating glass */
#define CS_PL_2X3    185.00      /* EA. 2' x 3' */
#define CS_PL_2X4    205.00      /* EA. 2' x 4' */
#define CS_PL_2X5    235.00      * EA. 2' x 5' */
#define CS_PL_2X6    275.00      /* EA. 2' x 6' */

 * casement, deluxe quality, metal clad, wood core, insulating glass */
#define CS_MTL_2X3   220.00      * EA. 2' x 3' */
#define CS_MTL_2X4   245.00      * EA. 2' x 4' */
#define CS_MTL_2X5   270.00      /* EA. 2' x 5' */
#define CS_MTL_2X6   325.00      * EA. 2' x 6' */

 * window hardware -- includes latch and handle, surface mounted */

#define AL_HARD   26.70          /* EA. Aluminum */
#define BR_HARD   27.25          /* EA. Bronze */
#define CH_HARD   26.95          /* EA. Chrome */

 * window trim and weatherstripping */

#define ZINC_WTHR       51.00    * EA. Zinc window weatherstripping */
#define BRNZ_WTHR       64.00    * EA. Bronze window weatherstripping */
#define VNL_WTHR        40.00    * EA. Vinyl V strip window weatherstripping */
#define TRIM_WNDW       37.00    * EA. Average window trim cost */
#define WNDW_PNT15      21.05    /* EA. Exterior side only, oilbase, primer, one coat, brush */

 * wall installation */

 * Stud installation includes double top plate, single bottom plate, taping, */
 * finishing, insulation, and painting both faces. Wall facing is not included */
 * Basically a system cost, assuming wall is finished both sides */
```

```
#define STUD2X3_8_16    3.20    /* SF. 2" x 3" studs, 8' high, 16" O.C. */
#define STUD2X3_8_24    3.00    /* SF.                        24" O.C. */
#define STUD2X3_10_16   3.05    /* SF.              10' high, 16" O.C. */
#define STUD2X3_10_24   2.88    /* SF.                        24" O.C. */
#define STUD2X4_8_16    3.25    /* SF. 2" x 4" studs, 8' high, 16" O.C. */
#define STUD2X4_8_24    3.05    /* SF.                        24" O.C. */
#define STUD2X4_10_16   3.09    /* SF. 2" x 4" studs, 10' high, 16" O.C. */
#define STUD2X4_10_24   2.91    /* SF.                        24" O.C. */
#define STUD25_2_24     2.83    /* SF. 25 ga. metal studs, 2.5" wide, 24" O.C. */
#define STUD25_3_24     2.89    /* SF.                     3-5/8" wide, 24" O.C. */
#define STUD25_2_16     3.00    /* SF.                     2.5" wide, 16" O.C. */
#define STUD25_3_16     3.08    /* SF.                     3-5/8" wide, 16" O.C. */
#define STUD20_2_24     2.96    /* SF. 20 ga. metal studs, 2.5" wide, 24" O.C. */
#define STUD20_3_24     3.15    /* SF.                     3-5/8" wide, 24" O.C. */
#define STUD20_2_16     3.17    /* SF.                     2.5" wide, 16" O.C. */
#define STUD20_3_16     3.40    /* SF.                     3-5/8" wide, 16" O.C. */

 * Gypsum wallboard facing for above stud system. 1 SF. is doubled for */
 * compenstation for both wall faces */
#define GYP_5_8S        1.20    /* 2*SF. Gypsum drywall, 5/8" thick, standard */
#define GYP_5_8F        1.26    /* 2*SF.                             fire resistant */
#define GYP_5_8W        1.38    /* 2*SF.                             water resistant */
#define GYP_1_2S        1.14    /* 2*SF.                 1/2" thick, standard */
#define GYP_1_2F        1.22    /* 2*SF.                             fire resistant */
#define GYP_1_2W        1.28    /* 2*SF.                             water resistant */
#define GYP_3_8VS       5.23    /* 2*SF.                 3/8" thick, vinyl faced, standard */
#define GYP_5_8VF       5.43    /* 2*SF.                 5/8" thick, vinyl faced, fire resistant */

 * Movable office partitions, demountable, */
 * no deduction for door openings, add for doors */
#define PRTN_AIR_S     19.50    /* SF. Avg., Air wall, cork finish, semi-acoustic, 1-5/8" thick */
#define PRTN_AIR_A     21.00    /* SF. Avg., Acoustic, 2" thick */
#define PRTN_GYP_L      2.97    /* SF. Gypsum, laminated, 2-1/4" thick, painted two sides */
#define PRTN_GYP_A      3.63    /* SF. Acoustical, 3" thick, painted two sides */
#define PRTN_DRY_V      3.08    /* SF. Vinyl clad drywall on 2-1/2" metal studs */
#define PRTN_DOORS    379.00    /* SF. Additional for each door -- hollow metal */


 * ceiling installation */

 * drywall, gypsum plasterboard, on ceiling, taped and finished */
#define CLNG_DRYS1      0.97    /* SF. Standard, 1/2" thick, */
#define CLNG_DRYS2      1.05    /* SF.          5/8" thick, */
#define CLNG_DRYF1      1.01    /* SF. Fire resistant, 1/2" thick */
#define CLNG_DRYF2      1.06    /* SF.                 5/8" thick */
#define CLNG_DRYW1      1.05    /* SF. Water resitant, 1/2" thick */
#define CLNG_DRYW2      1.12    /* SF.                 5/8" thick */

 * Lath & plaster, furring, suspended ceilings, including carriers */
#define CLNG_FRM_1      2.10    /* SF. 1-1/2" carriers, 24" O.C., 3/4" channels, 16" O.C. */
#define CLNG_FRM_2      1.79    /* SF.                                          24" O.C. */
#define CLNG_FRM_3      2.33    /* SF.                          1-1/2" channels, 16" O.C. */
#define CLNG_FRM_4      1.97    /* SF.                                           24" O.C. */
#define CLNG_FRM_5      2.30    /* SF. 2" carriers, 24" O.C., 3/4" channels, 16" O.C. */
#define CLNG_FRM_6      1.96    /* SF.                                      24" O.C. */
#define CLNG_FRM_7      2.54    /* SF.                        1-1/2" channels, 16" O.C. */
#define CLNG_FRM_8      2.14    /* SF.                                        24" O.C. */
```

```
 * Ceiling tile, stapled, cemented or installed on suspension system */
 * 12" x 12" or 12" x 24", not including furring */
#define CLNG_TLEMF1     1.81    /* SF. Mineral fiber, plastic coated, 5/8" thick */
#define CLNG_TLEMF2     1.86    /* SF.                                3/4" thick */
#define CLNG_TLEMFF1    1.86    /* SF. Mineral fiber, fire rated, plain faced, 3/4" thick */
#define CLNG_TLEMFF2    1.97    /* SF.                            plastic coated face, 3/4" thick */
#define CLNG_TLEWF1     1.22    /* SF. Wood fiber tile, 1/2" thick */
#define CLNG_TLEWF2     1.48    /* SF.                  3/4" thick */

 * Suspended acoustic ceiling boards, not including suspension system */
#define CLNG_PNLF_1     0.66    /* SF. Fiberglass boards, film faced, 2' x 2' or 2' x 4', 5/8" thick */
#define CLNG_PNLF_2     1.19    /* SF.                                                    3/4" thick */
#define CLNG_PNLG_1     1.59    /* SF. Glass cloth faced fiberglass, 3/4" thick */
#define CLNG_PNLG_2     2.06    * SF.                              5/8" thick */
#define CLNG_PNLA_1     1.29    /* SF. Mineral fiber boards, aluminum faced, 24" x 24", 5/8" thick */
#define CLNG_PNLS_1     0.66    /* SF.                       standard faced,                    */
#define CLNG_PNLP_1     1.03    /* SF.                       plastic coated face,               */
#define CLNG_PNL2_1     0.70    /* SF.                       2 hr. rating, 5/8" thick */

 * Suspension systems for boards and tile listed above */
#define CLNG_SUSP2X4    0.72    /* SF. Class A suspension system, T bar, 2' x 4' grid */
#define CLNG_SUSP2X2    0.82    /* SF.                                2' x 2' grid */
#define CLNG_SUSPZ_1    1.00    /* SF. Concealed Z bar suspension system, 12" module */
#define CLNG_CARRIER    0.67    /* SF. Additional for 1-1/2 carrier channels, 4' O.C. */
#define CLNG_ADD_LGT    0.28    /* SF. Add to carriers if recessed lighting fixtures */

 * Flooring installation */

 * Carpeting, commercial grade, cemented */
#define CRPT_A26        2.09    /* SF. Acrylic, 26 oz., light to medium traffic */
#define CRPT_A35        2.78    /* SF.         35 oz., medium to heavy traffic */
#define CRPT_N15        1.49    /* SF. Nylon, non anti-static, 15 oz., light traffic */
#define CRPT_N22        1.85    /* SF. Nylon, with anti-static, 22 oz., medium traffic */
#define CRPT_N26        2.11    /* SF.                          26 oz., heavy traffic */
#define CRPT_N28        2.66    /* SF.                          28 oz., heavy traffic */
#define CRPT_FB         2.30    /* SF. Tile, foam backed, needle punched */
#define CRPT_W36        4.22    /* SF. Wool, 36 oz., medium traffic */
#define CRPT_W42        4.22    /* SF.       42 oz., heavy traffic */

 * Padding, average costs *
#define PAD_R           0.75    /* SF. Sponge rubber cushion */
#define PAD_F           0.58    /* SF. Felt, 32 oz. to 56 oz. */
#define PAD_BU          0.65    /* SF. Bonded urethane, 3/8" thick */
#define PAD_PU          0.48    /* SF. Prime urethane, 1/4" thick */

 * Resilient tile *
#define ASPH_TLE_B      1.51    /* SF. Asphalt tile, on wood subfloor, 1/8" thick, color group B */
#define ASPH_TLE_C      1.56    /* SF.                                              color groups C & D */
#define POLY_FLR1       2.84    /* SF. Polyethelyne, rolls, nylon action surface, 1/8" thick, no base incl. */
#define POLY_FLR2       3.75    /* SF.                                            1/4" thick,              */
#define POLY_FLR3       4.80    /* SF.                                            3/8" thick,              */
#define RUBBR_1         3.08    /* SF. Rubber sheet goods, 36" wide, 1/8" thick */
#define RUBBR_2         3.92    /* SF.                               3/16" thick */
#define RUBBR_3         4.26    /* SF.                               1/4" thick */
#define VNYL_TLE_1      1.40    /* SF. Vinyl composition tile, 12" x 12", 1/16" thick */
#define VNYL_TLE_2      1.57    /* SF.                         embossed, 12" x 12", 1/16" thick */
#define VNYL_TLE_3      1.57    /* SF.                         marbelized, 12" x 12", 1/16" thick */
#define VNYL_TLE_4      1.60    /* SF.                         plain, 12" x12", 1/16" thick */
#define VNYL_TLE_5      1.66    /* SF.                         embossed, 12" x 12", 3/32 thick */
#define VNYL_TLE_6      1.75    /* SF.                         marbelized, 12" x 12", 3/32" thick */
```

```
#define VNYL_TLE_7      1.86    /* SF.                          plain, 12" x 12", 3/32" thick */
#define VNYL_SHT_1      2.70    /* SF. Vinyl sheet goods, backed, 0.070" thick, average cost */
#define VNYL_SHT_2      3.12    /* SF.                            0.093" thick, average cost */
#define VNYL_SHT_3      3.76    /* SF.                            0.125" thick, average cost */
#define VNYL_SHT_4      4.84    /* SF.                            0.250" thick, average cost */

 * Ceramic tile -- floor */
#define TILE_FLR_1      4.63    /* SF. Porcelain type, random color blend, 1" x 1" */
#define TILE_FLR_2      4.85    /* SF.                                    2" x 2" or 2" x 1", thin set */
#define TILE_FLR_3      4.45    /* SF. Natural clay, random or uniform, thin set, color group 2 */
#define TILE_FLR_4      6.25    /* SF. Pregrouted sheets, 2 sf. sheets, urethane adhesive, unglazed */
#define EPOXY           1.09    /* SF. additional for epoxy grout, average cost */

 * Ceramic tile -- walls */
#define EPOXY_WALL      0.91    /* SF. Additional for epoxy grout */
#define TILE_WALL_1     3.89    /* SF. Walls, interior, thin set, 4-1/4" x 4-1/4" tile */
#define TILE_WALL_2     4.17    /* SF.                            6" x 4-1/4" tile */
#define TILE_WALL_3     4.20    /* SF.                            6" x 6" tile */
#define TILE_WALL_4     6.55    /* SF. Crystalline glazed, 4-1/4" x 4-1/4" tile, mud set, plain */
#define TILE_WALL_5     6.75    /* SF.                     4-1/4" x 4-1/4" scored tile, mud set, plain */
#define TILE_WALL_6     9.65    /* SF.                     1-3/8"  squares,                          */
#define TILE_WALL_7     4.24    /* SF. Pregrouted sheets, 4 sf. sheets, silicon grout */

/* Refinishing of old wood floors */
#define MAX_RFNSH       2.67    /* SF. maximum cost */
#define MIN_RFNSH       1.12    /* SF. minimum cost */

 * siding installation */
#define SDNG_WDC_1      2.76    /* SF. Wood, cedar bevel, short lengths, A grade, 1/2" x 6" */
#define SDNG_WDC_2      2.92    /* SF.                                            1/2" x 8" */
#define SDNG_WDC_3      2.64    /* SF.                   3' to 16' lengths, clear grade, 3/4" x 10" */
#define SDNG_WDC_4      2.62    /* SF.                                      B grade,               */
#define SDNG_WDP_1      1.48    /* SF. White pine, rough sawn, 1" x 8", natural */
#define SDNG_WDP_2      1.57    /* SF.                                 stained */
#define SDNG_ALH_1      2.06    /* SF. Aluminum, horizontal, colored clapboard, 8" or 10" wide, plain */
#define SDNG_ALH_2      2.17    /* SF.                                                        insulated */
#define SDNG_ALH_3      2.10    /* SF.                                          8" embossed, painted */
#define SDNG_ALH_4      2.21    /* SF.                                                     insulated */
#define SDNG_ALH_5      1.94    /* SF.                                          12" painted,  smooth */
#define SDNG_ALH_6      2.07    /* SF.                                          12" insulated,       */
#define SDNG_ALH_7      1.96    /* SF.                                          12" embossed, painted */
#define SDNG_ALH_8      2.08    /* SF.                                                     insulated */
#define SDNG_ALBB       2.33    /* SF. Aluminum, vertical board and batten, colored, non-insulated */
#define SDNG_STL_1      1.68    /* SF. Steel siding, beveled, vinyl coated, 8" wide */
#define SDNG_STL_2      1.60    /* SF.                                      10" wide */
#define SDNG_VNYL_S     1.73    /* SF. Vinyl siding, solid PVC panels, 8" to 10" wide, plain */
#define SDNG_VNYL_SI    2.00    /* SF.                                                insulated */
#define SDNG_VNYL_C9    4.07    /* SF. Corrugated vinyl sheets, .090" thick */
#define SDNG_VNYL_C12   5.10    /* SF.                          .120" thick */
#define SDNG_VNYL_F1    2.73    /* SF. Flat vinyl sheets, with fibers, colored, 1/16" thick */
#define SDNG_VNYL_F2    3.55    /* SF.                                          1/8" thick */
#define SDNG_VNYL_FI1   5.15    /* SF.                Insulated sandwich panels, 1/16" skin, 1" thick */
#define SDNG_VNYL_FI2   7.40    /* SF.                                                       1-1/2" thick */

 * Exterior siding, paint */
#define XSTL_PNT_B      0.79    /* SF. Steel siding paint, oil base, primer or sealer coat, 2 final coats, brushed */
#define XSTL_PNT_S      0.48    /* SF.                                                                      spray */
#define XCLP_PNT_B      0.74    /* SF. Texture 1-11, or clapboard, oilbase, primer, paint, 2 final coats, brush */
#define XCLP_PNT_S      0.51    /* SF.                                                                     spray */
```

```
 * stair installation */
 * must take into account floor-floor ht. determine number of risers */
 * and the number of treads */

#define RSR_BEECH       8.40    /* LF. Riser, beech, 3/4" thick, x 7-1/2" high */
#define RSR_FIR         5.20    /* LF.       fir,                              */
#define RSR_OAK         7.50    /* LF.       oak,                              */
#define RSR_PINE        5.05    /* LF.       pine,                             */
#define TRD_9_3         30.00   /* EA. Treads, oak, 1-1/16" x 9-1/2" wide, 3' long */
#define TRD_11_3        33.00   /* EA.                      11-1/2" wide, 3' long */
#define TRD_9_4         37.00   /* EA.                      9-1/2" wide, 4' long */
#define TRD_11_6        58.00   /* EA.                      11-1/2" wide, 4' long */

 * lighting installation, includes lamps, mounting hardware, and connections */

 * Fluorescent, Cool White lamps, ceiling, rapid start */
#define LGHT_INT_R1     91.00   /* EA. Acrylic lens, recess mounted, 1'W x 4'L, two 40 watt */
#define LGHT_INT_R2     105.00  /* EA.                              2'W x 2'L, two U40 watt */
#define LGHT_INT_R3     115.00  /* EA.                              2'W x 4'L, four 40 watt */
#define LGHT_INT_S1     85.00   /* EA. Acrylic lens, surface mounted, hinged & latched, 1'W x 4'L, two 40 watt */
#define LGHT_INT_S2     110.00  /* EA.                                                  2'W x 2'L, two U40 watt */
#define LGHT_INT_S3     125.00  /* EA.                                                  2'W x 4'L, four 40 watt */
#define LGHT_INT_ST1    55.00   /* EA. Strip fixture, surface mounted, 4' long, one 40 watt */
#define LGHT_INT_ST2    58.00   /* EA.                                          two 40 watt */
#define LGHT_INT_ST3    78.00   /* EA.                                8' long, one 75 watt, slimline */
#define LGHT_INT_ST4    88.00   /* EA.                                          two 75 watt, slimline */
#define LGHT_INT_P1     105.00  /* EA. Pendent mounted, industrial, white enamel, 4' long, two 40 watt */
#define LGHT_INT_P2     140.00  /* EA.                                            4' long, two 60 watt, high output */
#define LGHT_INT_P3     150.00  /* EA.                                            8' long, two 75 watt, slimline */

 * Incandescent, ceiling, recess mounted, prewired */
#define LGHT_INC_100R   78.00   /* EA. Round alzak reflector, 100 watt */
#define LGHT_INC_150R   79.00   /* EA.                        150 watt */
#define LGHT_INC_300R   90.00   /* EA.                        300 watt */
#define LGHT_INC_100S   67.00   /* EA. Square glass lens w/trim, 100 watt */
#define LGHT_INC_200S   71.00   /* EA.                           200 watt */

 * Track lighting */
#define LGHT_TRK_1X4    74.00   /* EA. Track, one circuit, 4' section */
#define LGHT_TRK_1X8    100.00  /* EA.                    8' section */
#define LGHT_TRK_3X4    77.00   /* EA.       three circuits, 4' section */
#define LGHT_TRK_3X8    100.00  /* EA.                      8' section */

 * Residential fixtures */
#define LGHT_RES_150P   74.00   /* EA. Pendent globe with shade, 150 watt */
#define LGHT_RES_CIRC   62.00   /* EA. Fluorescent, interior, surface, circline, 32 watt and 40 watt */
#define LGHT_RES_2XU    100.00  /* EA.                                 2' x 2', two  U40 watt */
#define LGHT_RES_CAB    63.00   /* EA.                         shallow, under cabinet, two 20 watt */
#define LGHT_RES_WALL   69.00

 * Exterior fixtures, with lamps */
#define LGHT_EXT_Q      125.00  /* EA. Quartz, 500 watt */
#define LGHT_EXT_MV175  280.00  /* EA. Wall pack, mercury vapor, 175 watt */
#define LGHT_EXT_MV200  310.00  /* EA.                           250 watt */
#define LGHT_EXT_LS35   240.00  /* EA.           low pressure sodium, 35 watt */
#define LGHT_EXT_LS55   325.00  /* EA.                                55 watt */
#define LGHT_EXT_HS70   360.00  /* EA.           high pressure sodium, 70 watt */
#define LGHT_EXT_HS150  375.00  /* EA.                                150 watt */

 * Floodlights wiht ballast and lamp, pole mounted, pole not included */
```

```
#define LGHT_EXT_FLD1   540.00  /* EA. Low pressure sodium, 55 watt */
#define LGHT_EXT_FLD2   640.00  /* EA.                      90 watt */

/* Exit and emergency lighting */
#define EMGNCY_SX        79.00  /* EA. Exit light, ceiling or wall mount, incandescent, single face */
#define EMGNCY_DX        86.00  /* EA.                                                  double face */

/*  Emergency light units, battery operated, twin sealed beam, 25 watt, 6 volt ea. */
#define EMGNCY_25WL     280.00  /* EA. Lead battery operated */
#define EMGNCY_25WNA    430.00  /* EA. Nickel cadmium operated */

/* plumbing costs are determined by number of fixtures required */
/* piping costs estimated on percentage of fixture cost */

#define PIPE_LOW         0.30   /* Thirty percent of total fixture cost -- lower limit */
#define PIPE_HI          0.60   /* Sixty percent of total fixture cost -- upper limit */

/* water heater costs */

#define R_ELE_10        240.00  /* EA. Residential, electric, glass lined, 10 gal. single element */
#define R_GAS_20        300.00  /* EA.             gas, glass lined, no vent, 20 gal., single element */
#define C_ELE_5         955.00  /* EA. Commercial, electric, 5 gal., 3 KW, 12 GPH */
#define R_ELE_30        290.00  /* EA. Residential, electric, glass lined, 30 gal., double element */
#define R_ELE_40        315.00  /* EA.                                     40 gal.,               */
#define R_ELE_52        350.00  /* EA.                                     52 gal.,               */
#define R_ELE_66        410.00  /* EA.                                     66 gal.,               */
#define R_ELE_80        475.00  /* EA.                                     80 gal.,               */
#define R_GAS_30        315.00  /* EA. Residential, gas, glass lined, 30 gal., no vent incl. */
#define R_GAS_40        330.00  /* EA.                                40 gal.,              */
#define R_GAS_75        600.00  /* EA.                                75 gal.,              */
#define R_OIL_30        910.00  /* EA. Residential, oil fired, glass lined, 30 gal., no vent incl. */
#define R_OIL_50       1175.00  /* EA.                                     50 gal.,               */
#define C_ELE_50       1950.00  /* EA. Commercial, electric, 50 gal., 36 KW, 148 GPH */
#define C_ELE_400     12500.00  /* EA.                      400 gal., 210 KW, 860 GPH */
#define C_GAS_75        955.00  /* EA. Commercial, gas fired, flush jacket, std. controls, 75 MBH, 63 GPH, no vent */
#define C_GAS_96       1950.00  /* EA.                                                    96 MBH, 81 GPH          */
#define C_GAS_200      2325.00  /* EA.                                                    200 MBH, 192 GPH,       */
#define C_OIL_103      1625.00  /* EA. Commercial, oil fired, flush jacket, std. controls, 103 MBH, 116 GPH, no vent */
#define C_OIL_122      1675.00  /* EA.                                                    122 MBH, 141 GPH,        */
#define C_OIL_225      2825.00  /* EA.                                                    225 MBH, 256 GPH,        */


/* drinking fountain costs for connection to cold water supply */

/* Wall mounted, non-recessed, Stainless steel, single bubbler */
#define WFTN_NR_ST      635.00  /* EA. No back */
#define WFTN_NR_SD      400.00  /* EA. Dual handle, wheelchair projection type */
#define WFTN_NR_SH      710.00  /* EA. Dual level for handicapped type */

/* Wall mounted, semi-recessed */
#define WFTN_SR_MS      385.00  /* EA. Poly-marble, single bubbler */
#define WFTN_SR_SS      425.00  /* EA. Stainless steel, satin finish, single bubbler */

/* Wall mounted, fully recessed */
#define WFTB_FR_MS      520.00  /* EA. Poly-marble, single bubbler */
#define WFTN_FR_SS      455.00  /* EA. Stainless steel, single bubbler */

/* Floor mounted, pedestal type */
#define FFTN_PD_ID      755.00  /* EA. Enameled iron, heavy duty service, two bubblers */
```

```
#define FTN_ROUGH       180.00  /* EA. Rough-in, supply and waste, additional */

 * water closet costs */

/* Tank type, vitreous china, incl. seat, supply pipe with stop */
#define WC_WH_TNK1      610.00  /* EA. Wall hung, one piece */
#define WC_WH_TNK2      430.00  /* EA.           two piece, close coupled */
#define WC_WH_RGH       355.00  /* EA. Rough in, supply, waste, vent, and carrier for wall hung WC's */
#define WC_FM_TNK1      500.00  /* EA. Floor mounted, one piece */
#define WC_FM_TNK2      220.00  /* EA.               two piece, close coupled, water saver */
#define WC_FM_RGH       350.00  /* EA. Rough in, supply, waste, vent, and carrier for wall hung WC's */
#define WC_WH_BWL       345.00  /* EA. Wall hung, bowl only, with  flush valve, seat */
#define WC_WH_BRGH      385.00  /* EA. Rough in, supply, waste, and vent for single WC */

 * water cooler costs */

#define CLR_WM_4NR      440.00  /* EA. Wall mounted, non-recessed, 4 GPH */
#define CLR_WM_8NR      630.00  /* EA.                             8.2 GPH, dual height */
#define CLR_WM_14NR     660.00  /* EA.                             14.3 GPH,           */
#define CLR_WM_8SR      610.00  /* EA.              semi-recessed, 8.1 GPH */
#define CLR_FM_4FL      425.00  /* EA. Floor mounted, flush to wall, 4 GPH */
#define CLR_FM_8FL      695.00  /* EA.                               8.2 GPH, dual height */

 * lavatory costs */

 * With trim, white */
#define LAV_VNTY_20     200.00  /* EA. Vanity top, porcelain enamel on cast iron, 20" x 18" */
#define LAV_VNTY_26     230.00  /* EA.                                            26" x 18" oval */
#define LAV_RGH_VNTY    320.00  /* EA. Rough in, supply, waste, and vent for above lavatories */
#define LAV_WH_16       275.00  /* EA. Wall hung, porcelain enamel on cast iron, 16" x 14", single bowl */
#define LAV_WH_20       200.00  /* EA.                                            20" x 18", single bowl */
#define LAV_RGH         425.00  /* EA. Rough in, supply, waste, and vent for above lavatories */

 * sink costs */

 * Laundry sinks,  with trim */
#define LSNK_PRC_20     340.00  /* EA. Porcelain enamel on cast iron, black frame, 24" x 20", single */
#define LSNK_PRC_23     355.00  /* EA.                                             24" x 23", single */
#define LSNK_PL_18S     145.00  /* EA. Plastic, on wall hanger or legs, 18" x 23", single */
#define LSNK_PL_20S     165.00  /* EA.                                  20" x 24", single */
#define LSNK_PL_36D     195.00  /* EA.                                  36" x 23", double */
#define LSNK_PL_40D     245.00  /* EA.                                  40" x 24", double */
#define LSNK_RGH        340.00  /* EA. Rough in, supply, waste, and vent for all laundry sinks */

 * Sinks, with faucets and drain */
#define SNK_PRC_24S     285.00  /* EA. Kitchen, counter top, P.E. on C.I., 24" x 21", single */
#define SNK_PRC_30S     305.00  /* EA.                                     30" x 21", single */
#define SNK_PRC_32D     360.00  /* EA.                                     32" x 21", double */
#define SNK_STS_19S     395.00  /* EA. Stainless steel, self rimming, 19" x 18", single */
#define SNK_STS_25S     415.00  /* EA.                                  25" x 22", single */
#define SNK_STS_33D     465.00  /* EA.                                  33" x 22", double */
#define SNK_STS_43D     495.00  /* EA.                                  43" x 22", double */
#define SNK_ENM_24S     225.00  /* EA. Steel, enameled, with ledge, 24" x 21", single */
#define SNK_ENM_32D     270.00  /* EA.                              32" x 21", double */
#define SNK_RGH         340.00  /* EA. Rough in, supply, waste, and vent for all sinks */

 * urinal costs *

#define URNL_WH_C       495.00  /* EA. Wall hung, vitreous china, w/hanger and self closing valve */
#define URNL_WH_RGH     310.00  /* EA. Rough in, supply, waste, and vent for above urinal */
```

```
#define URNL_STL_C      605.00  /* EA. Stall type, vitreous china, includes valve */
#define URNL_STL_RGH    325.00  /* EA. Rough in, supply, waste, and vent for above urinal */

/* HVAC rehabilitation costs -- systems cost per square foot */

/* Oil fired hot water baseboard system incl. boiler, */
/* fin tube radiation & all necessary pipings and fittings */
#define OIL_WTR_1       6.80    /* SF. to 1000 sf. */
#define OIL_WTR_12      5.99    /* SF. to 1200 sf. */
#define OIL_WTR_16      5.78    /* SF. to 1600 sf. */
#define OIL_WTR_2       4.99    /* SF. to 2000 sf. */
#define OIL_WTR_3       3.96    /* SF. to 3000 sf. */
#define OIL_WTR_5       3.50    /* SF. over 3000 sf. */

/* Gas fired hot water heater baseboard system incl. boiler, */
/* fin tube radiation, and all necessary fittings and pipings */
#define GAS_WTR_1       6.03    /* SF. to 1000 sf. */
#define GAS_WTR_12      5.36    /* SF. to 1200 sf. */
#define GAS_WTR_16      5.31    /* SF. to 1600 sf. */
#define GAS_WTR_2       4.72    /* SF. to 2000 sf. */
#define GAS_WTR_3       3.99    /* SF. to 3000 sf. */
#define GAS_WTR_5       3.75    /* SF. over 3000 sf. */

/* Oil fired, forced hot air sys. incl. furnace, ductwork, */
/* registers, and all necessary hookups */
#define OIL_AIR_1       3.64    /* SF. to 1000 sf. */
#define OIL_AIR_12      3.21    /* SF. to 1200 sf. */
#define OIL_AIR_16      2.67    /* SF. to 1600 sf. */
#define OIL_AIR_2       3.12    /* SF. to 2000 sf. */
#define OIL_AIR_3       2.53    /* SF. to 3000 sf. */
#define OIL_AIR_5       2.56    /* SF. over 3000 sf. */

/* Gas fired, forced hot air sys., incl. furnace, ductwork, */
/* registers, and all necessary hookups */
#define GAS_AIR_1       2.96    /* SF. to 1000 sf. */
#define GAS_AIR_12      2.64    /* SF. to 1200 sf. */
#define GAS_AIR_16      2.50    /* SF. to 1600 sf. */
#define GAS_AIR_2       2.77    /* SF. to 2000 sf. */
#define GAS_AIR_3       2.25    /* SF. to 3000 sf. */
#define GAS_AIR_5       2.12    /* SF. over 3000 sf. */

/* Oil fired, heating and cooling, forced air sys., incl. furnace, */
/* ductwork, registers, and all necessary hookups */
#define OIL_2AIR_1      5.23    /* SF. to 1000 sf. */
#define OIL_2AIR_12     4.53    /* SF. to 1200 sf. */
#define OIL_2AIR_16     3.72    /* SF. to 1600 sf. */
#define OIL_2AIR_2      4.03    /* SF. to 2000 sf. */
#define OIL_2AIR_3      3.36    /* SF. to 3000 sf. */
#define OIL_2AIR_5      3.03    /* SF. over 3000 sf. */

/* Gas fired, heating and cooling, forced air sys., incl. furnace, */
/* ductwork, registers, and all necessary hookups */
#define GAS_2AIR_1      4.56    /* SF. to 1000 sf. */
#define GAS_2AIR_12     3.97    /* SF. to 1200 sf. */
#define GAS_2AIR_16     3.54    /* SF. to 1600 sf. */
#define GAS_2AIR_2      3.68    /* SF. to 2000 sf. */
#define GAS_2AIR_3      3.08    /* SF. to 3000 sf. */
#define GAS_2AIR_5      2.87    /* SF. over 3000 sf. */

/* electrical rehabilitation costs */
```

```
/* outlet boxes */

#define BOX_OCT_M       14.60   /* EA. Pressed steel, octagon, 4" */
#define BOX_SQR_M       16.30   /* EA.               square, 4" */
#define BOX_CVR_M       4.72    /* EA.               covers, blank */
#define BOX_SWB_M       12.40   /* EA.               switch box */
#define BOX_RND_P       13.45   /* EA. Plastic, round, 4", w/2 mounting nails, bar hanger mounted */
#define BOX_SQR_P       12.90   /* EA.          square, 4", w/2 mounting nails */
#define BOX_SWB_P       10.60   /* EA.          switch box, w/2 mounting nails, 1 gang */

 * wiring devices */

#define SWITCH_15       12.00   /* EA. Toggle switch, quiet type, single pole, 15 amp */
#define SWITCH_20       18.40   /* EA.                                        20 amp */
#define SWITCH_3W       19.45   /* EA.                              3 way, 15 amp */
#define SWITCH_4W       40.00   /* EA.                              4 way, 15 amp */
#define RECPTCLE_15     11.35   /* EA. Receptacle, duplex, 120V grounded, 15 amp */
#define RECPTCLE_20     17.70   /* EA.                                    20 amp */
#define PLATES_1G       5.80    /* EA. Wall plates, stainless steel, 1 gang */
#define PLATES_2G       10.10   /* EA.                                2 gang */

 * safety switches */

 * General duty, 240 volt, 3 pole, fused */
#define SAFETY_30       120.00  /* EA. 30 amp */
#define SAFETY_60       185.00  /* EA. 60 amp */
#define SAFETY_100      255.00  /* EA. 100 amp */
#define SAFETY_200      450.00  /* EA. 200 amp */
#define SAFETY_400      830.00  /* EA. 400 amp */

 * conduit */

 * Conduit to 15' high, includes two terminations, 2 elbows, */
 * and 10 beam clips per 100 L.F. */
#define CON1X2_IMC      3.31    /* LF. Steel intermediate conduit (IMC), 1/2" dia. */
#define CON3X4_IMC      3.73    /* LF.                                   3/4" dia. */
#define CON1_IMC        4.92    /* LF.                                   1" dia. */
#define CON1IX4_IMC     5.50    /* LF.                                   1-1/4" dia. */
#define CON1IX2_IMC     6.15    /* LF.                                   1-1/2" dia. */
#define CON2_IMC        7.65    /* LF.                                   2" dia. */
#define CON2IX2_IMC     10.40   /* LF.                                   2-1/2" dia. */
#define CON3_IMC        14.00   /* LF.                                   3" dia. */
#define CON3IX2_IMC     15.65   /* LF.                                   3-1/2" dia. */
#define CON1X2_EMT      1.97    /* LF. Electric metallic tubing (EMT),  1/2" dia. */
#define CON3X4_EMT      2.58    /* LF.                                  3/4" dia. */
#define CON1_EMT        3.08    /* LF.                                  1" dia. */
#define CON1IX4_EMT     3.76    /* LF.                                  1-1/4" dia. */
#define CON1IX2_EMT     4.32    /* LF.                                  1-1/2" dia. */
#define CON2_EMT        5.15    /* LF.                                  2" dia. */
#define CON2IX2_EMT     7.95    /* LF.                                  2-1/2" dia. */
#define CON3_EMT        9.75    /* LF.                                  3" dia. */
#define CON3IX2_EMT     11.35   /* LF.                                  3-1/2" dia. */

 * panelboards */

 * NQOB, with 20 amp, 1 pole, bolt on circuit breakers */
#define NQOB_3_10       560.00  /* EA. 3 wire, 120/240 volts, 100 amp main lugs, 10 circuits */
#define NQOB_3_14       640.00  /* EA.                                           14 circuits */
#define NQOB_3_18       755.00  /* EA.                                           18 circuits */
#define NQOB_3_20       835.00  /* EA.                                           20 circuits */
```

```
#define NQOB_4_12       600.00  /* EA. 4 wire, 120/208 volts, 100 amp main lugs, 12 circuits */
#define NQOB_4_16       750.00  /* EA.                                           16 circuits */
#define NQOB_4_20       860.00  /* EA.                                           20 circuits */
#define NQOB_4_24       955.00  /* EA.                                           24 circuits */
#define NQOB_4_30      1100.00  /* EA.                                           30 circuits */
#define NQOB_4_32      1225.00  /* EA.                     225 amp main lugs, 32 circuits */
#define NQOB_4_34      1300.00  /* EA.                                           34 circuits */
#define NQOB_4_36      1350.00  /* EA.                                           36 circuits */
#define NQOB_4_42      1550.00  /* EA.                                           42 circuits */

/* NEHB, with 20 amp, 1 pole, bolt on circuit breakers */
#define NEHB_4_12       970.00  /* EA. 4 wire, 277/480 volts, 100 amp main lugs, 12 circuits */
#define NEHB_4_20      1425.00  /* EA.                                           20 circuits */
#define NEHB_4_24      1750.00  /* EA.                     225 amp main lugs, 24 circuits */
#define NEHB_4_30      2050.00  /* EA.                                           30 circuits */
#define NEHB_4_36      2350.00  /* EA.                                           36 circuits */

/* framing rehabilitation costs */

#define RFTR_2X6        0.95    /* LF. Rafters, to 4 in 12 pitch, 2" x 6" */
#define RFTR_2X8        1.16    /* LF.                            2" x 8" */
#define RFTR_HV_2X6     1.10    /* LF. Hip and valley rafters, 2" x 6" */
#define RFTR_HV_2X8     1.34    /* LF.                          2" x 8" */
#define RFTR_JK_2X6     1.31    /* LF. Hip and valley jacks, 2" x 6" */
#define RFTR_JK_2X8     1.69    /* LF.                        2" x 8" */
#define BEAMS_2X6       1.18    /* LF. Beams and Girders, single, 2" x 6" */
#define BEAMS_2X8       1.42    /* LF.                            2" x 8" */
#define BEAMS_2X10      1.70    /* LF.                            2" x 10" */
#define BEAMS_2X12      1.95    /* LF.                            2" x 12" */
#define BEAMS_2X14      2.20    /* LF.                            2" x 14" */
#define BEAMS_3X6       1.90    /* LF.                            3" x 6" */
#define BEAMS_3X10      2.64    /* LF.                            3" x 10" */
#define BEAMS_3X12      3.05    /* LF.                            3" x 12" */
#define BEAMS_3X14      3.51    /* LF.                            3" x 14" */
#define JOISTS_2X4      0.69    /* LF. Joists, 2" x 4" */
#define JOISTS_2X6      0.84    /* LF.         2" x 6" */
#define JOISTS_2X8      1.08    /* LF.         2" x 8" */
#define JOISTS_2X10     1.40    /* LF.         2" x 10" */
#define JOISTS_2X12     1.56    /* LF.         2" x 12" */
#define JOISTS_2X14     1.88    /* LF.         2" x 14" */
#define JOISTS_3X6      1.50    /* LF.         3" x 6" */
#define JOISTS_3X10     2.24    /* LF.         3" x 10" */
#define JOISTS_3X12     2.74    /* LF.         3" x 12" */

/* interior concrete slab on grade systems cost */

 * Ground slab, vapor barrier, welded wire fabric, */
 *  6" granular base, screed, and steel trowel finish */
#define SLAB_4R         2.08    /* SF. 4" thick slab, 3000 psi concrete */
#define SLAB_5R         2.28    /* SF. 5" thick slab, 3000 psi concrete */
#define SLAB_6R         2.55    /* SF. 6" thick slab, 3000 psi concrete */

/* concrete spread footing systems cost */

/* Column footings, including forms, reinforcing, and anchor bolts */
#define SPREAD_3X2      68.26   /* EA. 3' square, 1' thick, 2000 psi concrete */
#define SPREAD_3X3      69.58   /* EA.                      3000 psi concrete */
#define SPREAD_4X2     103.90   /* EA. 4' square, 1' thick, 2000 psi concrete */
#define SPREAD_4X3     106.26   /* EA.                      3000 psi concrete */
#define SPREAD_5X2      182.45  /* EA. 5' square, 1'-3" thick, 2000 psi concrete */
```

```
#define SPREAD_5X3      187.09  /* EA.                          3000 psi concrete */

 * concrete strip footing systems cost */

 * Strip footing, including forms, reinforcing, keyway, and dowels */
#define STRIP_2X2       14.45   /* LF. 2' wide x 1' thick, 2000 psi concrete */
#define STRIP_2X3       14.74   /* LF.                     3000 psi concrete */
#define STRIP_2HX2      16.10   /* LF. 2'-6" wide x 1' thick, 2000 psi concrete */
#define STRIP_2HX3      16.47   /* LF.                        3000 psi concrete */
#define STRIP_3X2       17.60   /* LF. 3' wide x 1' thick, 2000 psi concrete */
#define STRIP_3X3       18.04   /* LF.                     3000 psi concrete */

 * subfloor rehabilitation costs */

#define SUB_CDX_1       0.83    /* SF. Plywood, CDX, 1/2" thick */
#define SUB_CDX_2       0.92    /* SF.               5/8" thick */
#define SUB_CDX_3       1.02    /* SF.               3/4" thick */
#define SUB_TG_1        1.61    /* SF. Wood fiber, T&G, 2' x 8' planks, 1" thick */
#define SUB_TG_2        2.01    /* SF.                                  1-3/8" thick */

 * underlayment rehabilitation costs */
#define UNDR_PLY_1      0.82    /* SF. Plywood, underlayment grade, 3/8" thick */
#define UNDR_PLY_2      0.89    /* SF.                              1/2" thick */
#define UNDR_PLY_3      1.03    /* SF.                              5/8" thick */
#define UNDR_PLY_4      1.15    /* SF.                              3/4" thick */
#define UNDR_PRT_1      0.61    /* SF. Particle board, 3/8" thick */
#define UNDR_PRT_2      0.63    /* SF.                 1/2" thick */
#define UNDR_PRT_3      0.69    /* SF.                 5/8" thick */
#define UNDR_PRT_4      0.78    /* SF.                 3/4" thick */
```

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